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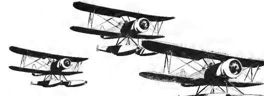
AVIATION

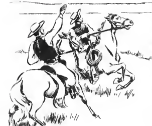
The Oldest American Aeronautical Magazine



Stearman

under the SOUTHERN CROSS

INTO the Argentine sky has come a fleet of sturdy STEARMAN advanced training and expeditionary planes, ably bearing the colors of the Argentine Ministry of Marine.



Built to the exacting standards of the United States Army and Navy, they are daily proving their stamina in the rigors of military service.

The Argentine Republic, pleased with its initial fleet of these planes, has just taken delivery of an additional fleet — a testimonial to the quality of equipment built by STEARMAN, contractors to the United States and foreign governments.

THE STEARMAN AIRCRAFT COMPANY, WICHITA, KANSAS. AFFILIATE OF THE BOEING AIRCRAFT COMPANY

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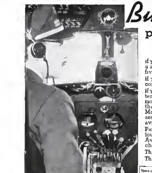

Parks graduates are piloting on airlines in both hemispheres

But... if it is the BETTER positions in aviation that *You* are after...

if you have your eye on the greater opportunities that a still greater industry will offer you in ten years or five... or even two years...

if you know that these greater opportunities will be commanded by men of superior ability... and

if you want for yourself foundation training which, for ten years, has proven its worth by developing superior ability in men who right now, in every branch of the industry... Professional Piloting, Operations, Manufacturing, Maintenance and in Engineering... are helping to develop the limitless possibilities of aviation... then

Parks Air College invites your consideration of the four major courses: Professional Flight and Executive, Aviation Operations and Executive, Aviation Mechanics, Aeronautical Engineering.

The catalog includes complete information.

The filled-in coupon will bring you a copy. It is free

Interesting Facts About Parks Air College

There is a capacity enrollment of 302 for the Fall term. Graduations will result in only a few vacancies for the Winter term which opens January 4. Early application is advisable.

Founded by its President, Oliver L. Parks, August 1, 1927.

Airport of 100 acres and school plant of 14 buildings are devoted to school purposes exclusively.

Dining hall and 5 dormitories for the use of Parks students.

Twelve training planes on the flight line. 65,000 hours of flight training have been given.

Four courses, each requiring 96 to 108 weeks of resident training, lead to the Bachelor of Science degree.

Fall term enrollment of 302. Faculty and officers number 33.

The maintenance of high standards results in a ready demand for all available graduates.

Wherever there is aviation activity, there you will find Parks graduates →

An air view of Parks Air College, the only institution in the World having its own airport and devoting all its facilities exclusively to providing training of college and professional school calibre in the four major fields of commercial aviation. 11th YEAR

Fully approved as a Transport, Ground and Flying School and Mechanics' School by the U. S. Dept. of Commerce

Accredited by the Illinois Superintendent of Public Instruction

High school graduation is prerequisite to admission.

Visits of inspection are welcomed.

Winter Term, January 4
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PARKS AIR COLLEGE

SECTION 12-AV — EAST ST. LOUIS, ILL.

Please mail me, without charge, the Parks Air College catalog.

Name ______________________ Age ____

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City ______________________ State ______

Four major courses, each leading to the Bachelor of Science degree are offered:
- Professional Flight and Executive
- Aviation Operations and Executive
- Aviation Mechanics
- Aeronautical Engineering

The Birdmen's Perch

Now that we come to think of E. L.'s letter, what DOES happen when a prop makes accidental mince meat out of buzzards "on the wing?" If any of you cloud-hoppers have any first-hand information of just what happens when a bird flies into a prop, scribble a line quick, too.

MAJOR AL WILLIAMS alias "Tattered Wing-Tips" Mgr. *Aviation Dept.*, Gulf Aviation Products, Gulf Bldg., Pittsburgh, Pa.

CORRESPONDENCE WANTED FROM KANGAROO LAND

"I am anxious to strike up a correspondence with some one, under the age of twenty, keen on aviation, residing in U.S.A. who has pictures to trade.

I am interested in all first hand activities concerning airplanes."

—Frank McEgon, 157 Murrumbeena Rd., Carnegie, S.E. 9, Melbourne, Australia

MAN VS. BIRD

"I'm a little touchy about having my veracity doubted—and I've gotten the 'bird' *twice*!

I can't tell exactly how the first one happened, because I was flying blind at the time, but I felt the sensation of a jerk and a hesitation of the motor—then everything kept on smoothly.

When I got down, I found eagle feathers stuck all around in open vents, etc. And Major, if there's any way of collecting eagle feathers two miles up in the air, outside of clipping an eagle with my prop, I don't know about it.

I got the second 'bird' because the boys

claimed *I* should have been mince-meat instead of the eagle. How about putting in a word for me?" —E. L., Brooklyn, N. Y.

ARE NAVIGATORS SMART?

"Tattered Wing-Tips" is neutral. But the following test of ingenuity promoted quite a squabble recently. Out of *five* flying gents, *one* never solved it at all, *three* solved it with pencil and paper, while one ingenious gent solved it in his head. "T. W. T." thought readers might like a whack at it—without pencil. Here goes:

A birdman, heading directly into the wind, passed a toy balloon just as he passed a church steeple. Fifteen minutes later he decided to take another look, turned, and headed with the wind, caught up to the balloon again 14 miles past the steeple. He had no instruments. What was the wind velocity?

"T. W. T." will be glad to acknowledge queries as to the correct answer.

WINGS ON AUTOS

To get that airplane performance from your auto, just try *Gulf No-Nox Gasoline*. *Gulf No-Nox* sure *does* have what it takes to put "wings" on tired gas buggies!

> **REFINED STORY DEPT**
>
> *Gulfpride* Oil made from 100% Pure Pennsylvania, is refined by the exclusive Alchlor Process that continues refining where other processes stop.
>
> By actual tests the Alchlor Process eliminates as much as 20% additional black gummy waste! *Result: Gulfpride is the world's finest oil for planes!*

THIS MONTH'S WHOPPER

"I, Sergei am great Rooshian dancer who hold world record for to jump, to keek and to spin, in famous ballet. I haf much troubles with ugly wife, Olga, but Gulf fix O.K.

Olga, who is dance partner, no like so much I dreenk the vodka before dance. But, Meestre Al, vodka make Sergei to dance fine! It make Sergei to spin like tops, to keek high, like so!

Sometimes Sergei feel so good when he spin he keek Olga in chin by purpose.

Swish!—*that night happens accident* . . .

Ah, sooch wimmins! She revenge Sergei very bad.

When we come to America, Olga put hair-tonic in Sergei's vodka. The dance it is ter reeble! But smart little girl from Caucasse see all. She no like Olga. Like Sergei. So! One night she empty hair tonic vodka, and replace with what you call the *Gulf Aviation Gas*.

Meestre Al, that night happens accident, I promise you! Sergei spin like aero planes propeller! I spin so fast I grab for somethings to stop. I catch only thread of dress of Olga—*Swish!*—and I am spool of thread while Olga is bare Rooshian baby! Poleece come, say 'Ha! So a Bubble Dance it pulls!' and Olga ride off in droshky with siren.

So! Now Sergei dance with smart little partner from Caucasse. Both, we dreenk the *Gulf Aviation Gas*. She spin on top of Sergei's head, and Sergei spin in opposite direction with both feet in air at once. I am sensation!

But poleece come, say 'Sergei, we haf take Olga by mistakes to monkey zoo, and now no one can tell from monkies. Come, pick out your Olga!' So, Meestre Al, Sergei go to zoo and pick out nice real chimpanzee. I no fool, eh?

Olga still in zoo, thanks *Gulf*, O.K.!"—L. C.

Gulf Oil Corporation and Gulf Refining Company . . . makers of

GULF AVIATION PRODUCTS

New Wings over CANADA

FASTEST Coast to Coast Schedule in North America

Seizing an advantage with the most advanced type transport yet developed, Trans-Canada Air-lines is pioneering a transcontinental route with the fastest flight schedules in North America. New Lockheed "14" transports have been selected. This equipment is **35 miles per hour faster** than planes used by U. S. airlines flying from coast to coast. With luxurious accommodations for 11 passengers and a crew of three, and the greatest cargo capacity ever built into a plane of its size, the "14", with a top speed of 250 m. p. h. is the fastest transport built. LOCKHEED AIRCRAFT CORP., Burbank, Calif. New York, 614 Chrysler Building. Chicago, 2353 Field Building. Dallas, Love Field.

LOCKHEED

14

Europe, Asia Minor, India, Africa—Factory Representative Norman Ebin, Assistant Ferris M. Smith c/o "Emisho," Warsaw, Poland. **South Africa**—Thos. Barlow & Sons, Johannesburg. **South America**—Factory Representative Henry J. White, Rio de Janeiro, Brazil.

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Now—more than two months in advance—the assured features of the 1938 International Air Show at Chicago make this the most successful trade and popular aviation show ever held. • It will be the largest show in actual physical size, in number and variety of aircraft shown, in completeness of representation by aircraft and accessory manufacturers, in educational features, in trade and technical meetings, and in opportunity for productive sales effort. • Plan now to take part in the one big show of the year—to share in the advantages available only at the 1938 International Air Show.

CLASS "A" SHOW The 1938 International Air Show at Chicago is the *first* Class "A" sanctioned show ever held. Sanctioned by Aeronautical Chamber of Commerce of America, Inc.

COMPLETE For the first time, the exhibits and features of this show will present a complete picture of the aviation industry, including private, commercial and transport, and military aeronautics.

MORE EXHIBITS Present space reservations assure participation by far more aircraft manufacturers than at any previous show. Engine, parts and accessory manufacturers, and service organizations will be most completely represented. Many concerns never before exhibiting will display their products at this show.

MORE MODELS From the spectacular display of giant military and commercial ships to the exhibits of the popular light planes, the 1938 Air Show will present every variety of present-day aircraft. The majority of manufacturers will exhibit at least two models. Many will show three or more different types.

EDUCATION An entire floor (over 50,000 sq. ft.) will be devoted to educational displays. Included will be exhibits of the Army, Navy, Coast Guard, Bureau of Air Commerce, and National Advisory Committee for Aeronautics.

AIR TRANSPORT The leading air transport operators are preparing comprehensive exhibits showing the latest scientific equipment for modern air transportation.

SPECTACULAR ARENA SHOW The entire Arena of the International Amphitheatre will be devoted to a display of giant military and commercial airplanes of the most modern types, including a Douglas Sleeper Plane, an Army Bomber, and amphibious types exhibited afloat. A spectacular show will be presented on the Arena stage, with two performances each day.

AIR SHOW POST OFFICE Regular Postal Service will be furnished by a special Post Office in the International Amphitheatre having an Air Show cancellation and maintaining direct service to the Chicago Municipal Airport.

THE AVIATION INDUSTRY'S TRADE SHOW The 1938 Air Show will be the Trade Show of the industry as well as a great popular exhibition. It is the only Class "A" Sanctioned Aeronautical Show, leaders in every branch of the industry are participating, important association and technical meetings will coincide with the Show. There will be no other opportunity to reap the benefits offered by the business and educational features of the 1938 Air Show.

THE WORLD'S FINEST LOCATION Chicago's International Amphitheatre—selected by the aviation industry for its 1938 Air Show—has every convenience available, making it easy to present a great show of a type that would be impossible elsewhere. Some of the features of this "City Within a City" are: **Approved Landing Strip** just outside the Amphitheatre. Exhibit ships can be flown in. **Size**—a total of 255,000 feet of exhibit space—well lighted, heated, ventilated, and easily accessible. **Superior hotel accommodations**, including the Stock Yard Inn adjoining the Amphitheatre. **Transportation**—the Amphitheatre is easily and quickly reached by all forms of local transportation from any part of Chicago. **Freight**—direct service via Chicago Junction Railway on private switch tracks at the building. **Service**—handling and installing exhibits, electricity, gas, water, skilled labor, and other exhibit services all provided by the Amphitheatre permanent staff. This means minimum cost and undivided responsibility. **Tremendous Trifles**—barber shop, valet, telegraph service, post office, lounge, meeting rooms, cafeteria, restaurants—all are here for your convenience. **Parking**—15 acres of free, lighted, policed parking space operated by the Air Show management.

Make your plans NOW!

There is still space available for a representative exhibit of your products, still time to arrange for participation in the 1938 International Air Show. Write or telegraph for detailed information on space available.

JANUARY 28 • FEBRUARY 6, 1938

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DIVISION OF

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BOEING SCHOOL of AERONAUTICS
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ALREADY, men who graduated from Boeing School within the past few years *are standing out in aviation*.

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School equipment includes 15 industry-type shops and laboratories, 10 planes of 8 distinct types—from a modern, 165 h.p. trainer to 1100 h.p. multi-motored Boeing 247 transport.

Get the facts about United States approved Boeing School of Aeronautics—the school for *career men*. The coupon will bring you complete information, promptly.

Next regular enrollment January 3, 1938

"Air Transport Engineering" *and* "Practical Aeronautical Engineering"

Two new courses, created by Boeing School after extensive consultations with leading manufacturing and operating companies. Graduates will find excellent opportunities in the engineering fields of Design, Transportation, Sales, Flight, Production — and in automotive, semi-technical and general engineering. Either course takes 24 months to complete—covers the equivalent of 3 years of college. *Prerequisite:* 2 years of pre-engineering at an accredited junior college or college.

7 GROUND COURSES . . . from 12 weeks' "Aircraft Sheet Metal" course to 24 month engineering courses.

7 PILOT COURSES . . . including 18-month "Airline Pilot and Operations" course, the standard of America.

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Name ________ *Age* ____
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THE OLDEST AMERICAN AERONAUTICAL MAGAZINE

AVIATION

Established 1916

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Contents for Vol. 36, No. 12

DECEMBER 1937

Flashes

From the Skyways of the World

» JUST FIGURED IT OUT that in the last two months the editorial staff of AVIATION has travelled upwards of 15,000 miles hither and thither, practically all by air. Besides the visiting about incidental to the Cleveland Races (Taylor Aircraft Taylor-Young, Lycoming RCA, Fleetwings, Luscombe, etc) and our second Bermuda flight as reported in last month's Flashes, our West Coast Editor recently wound up a transcontinental round trip which took him through the middle- and south west areas, and your editor has just returned from a two weeks' cruise into the northwest territories Altogether, during the twelve months that end with the first of December, AVIATION has covered personally for its readers every corner of the United States and a large section of Europe In that time we have flown over most of the air routes in the country and abroad, and have visited many of the principal airports And there are few manufacturing plants where new projects are under way that we have missed We're rather proud of the fact that AVIATION isn't run on a "paste pot and scissors" policy We're pretty much "from Missouri" when it comes to gathering material for the book

» McREYNOLDS came east via TWA with a stop at Kansas City to see the maintenance base there Westbound, he did a little zigging and zagging (via TWA, Braniff, and a few assorted bus lines), touching at Chicago Kansas City, Wichita, Oklahoma City, Tulsa, Dallas, Ft Worth, Amarillo, Albuquerque and L A Every morning for two weeks our office mail bulged with reports of Mac's findings in the field Unfortunately we can't print them in full, but here are some notes

» (CHICAGO) BENNY HOWARD'S PLANT going full blast with nineteen ships delivered in last year, including two just shipped off to Mexico Saw eight in various stages on production line Plans call for 50 60 plane program for 1938. Aircraft show prospects look good, a real set-up with real backing Show management 'hard hitting, intelligent,—and am convinced they will stage the greatest American show in history . . a real industry opportunity ' . (Kansas City) Spent two interesting days with Homer Bredouw, Tex LaGrone (Waco), Bill Ong, the Rearwins, Ed. Porterfield, Victor Roos, Siebenthaler, also TWA personnel (Wichita) Had nice visit with Sam Bloomfield and Opie Swope of Swallow They had a very business like 2-place Menasco powered coupe complete with ATC in test flight stages, more of which later. . . Saw Cessna's production activities with Dwane Wallace . . A plesant visit and a long talk with Earl Schaeffer of Stearman on production and export problems . . . Beech is booming right along with third twin motor in final stages and fourth and fifth under active construction . (Tulsa) Spartan in active production of Executives (see description, AVIATION, November, 1937) . Les Green at Spartan School sponsoring an interesting program of cross-country flying for his students Formation of five ships went to Cleveland for the Races . (Dallas) Much impressed by the neatness and obvious efficiency of Braniff's maintenance shops at Love field Regan Stunkel, after his five months with Braniff has 'one of the sweetest

In This Issue

Ed Aiten is with us again with a discussion of some of the problems facing test pilots . . . Lt. Commdr. Weems with another of his series of lessons in navigation. . . How to short-cut long and involved calculations by graphical methods is the theme of two articles by Mr Menness, the first of which appears in this issue The author is in the stress department of the Douglas Company . Claude Ryan discloses some of the details of his shop practices on SC production. . . Martin's new flying boat and more information on the Waco three wheeler are features of this month's Flying Equipment. . Just as we were about to go to press a shipment of photographs of the Milan Show arrived from our German Correspondent, Fritz Wittekind. With the help of a shoe horn we managed to get them into this issue

•

On page 58 of October issue the "world's largest" Hydraulic Press at the Douglas plant should have been credited with 5000 TONS instead of 5000 pounds

running organizations I've ever seen" "Mac" is now back on his Los Angeles base keeping tabs on AVIATION affairs west of the Rockies

» OUR OWN RECENT TRAVELS took us into a different section of the country, but proved no less interesting Shoved off on Oct. 17 on one of United's 14-passenger Mainliners westbound from Newark, and, in the course of the following week, went through to Seattle, with stops at Cleveland, Chicago, Cheyenne and Salt Lake City After a couple of days visiting with Boeing and other aviation activities at Seattle came east over Northwest Airlines route to Minneapolis and St Paul, for a day or so at NWA headquarters and maintenance shops Later to Chicago where we picked up UAL again for a fast hop (three hours 25 min) to Newark on Trip 20 on Oct 30

» IN CHICAGO we spent part of a day with Jack Vilas (Pyle-National), Jim Dunbar and Maynard Schreiver going over Show plans, and having a look at the International Auditorium Certainly few buildings in the country could be more suitable for exhibiting aircraft large and small And plans are afoot for decorative effects and for the mounting of exhibits that should be spectacular, to say the least

Maguire got CAR 40.6142 mixed with CAR 40.6124

» IN THE TWO YEARS that had elapsed since we had last visited the Cheyenne base of United Air Lines many changes have taken place both in buildings and equipment The same was true of Northwest Airlines' St Paul shops Two days in each plant gave us a chance to get caught up with progress We brought back a flock of pictures and a bagful of information on these shops which we hope to make available to readers in early issues

» WE WERE FORTUNATE in being in Seattle during some early test flights of the BX-15 bomber, the army's "Project A", so long on the secret list Can't say much about it beyond what has already appeared in AVIATION, except that it seems to get up and fly with all the ease and agility of a much smaller ship Ed Allen is doing the test flying with Major Corkile and Captain Ervine on hand as Air Corps observers

» STANDING ON BOEING FIELD while XB-15 went by overhead shortly after take off one bystander was heard to remark "By gosh!—It looks like a small overcast!" (See AVIATION NEWS) Actually, the YB-17s looked like small planes after watching the XB-15!

» PROBABLY we'll get the same sort of reaction from observers when Boeing's big flying boats now being built for Pan American get into the air. Two of them are now well along toward completion, and the shop is full of parts and subassemblies for at least four more. It is most impressive to climb through the hugh hulls and to peer into the partly finished wings with their spars that are almost as big as railway bridge girders!

» COMING EAST between Minneapolis and Chicago we had a chance to ride behind Mal Freeberg in one of NWA's new Lockheed 14 "Sky Zephyrs". Quite an airplane! Far more comfortable than the old Electras,—and she seems to pack performance to spare The way she gets off the ground and right upstairs is something to write home about. We made the 360 odd mile run in an hour and 50 minutes, including a stop at Rochester.

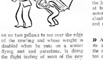
» WE WANT TO CONGRATULATE W T. Piper and Ted Weld on the fine turn out at their distributors meeting While there we renewed acquaintance with a good many of the more progressive operators from all parts of the country No wonder Cub sales for this year will come close to the one thousand mark

Side Slips

By
ROBERT
OSBORN

» PROBABLY it is just the working of nature's law of compensation or something, but we are always amazed to find that the smallest men marry the largest women, piano movers always seem to weigh about 129 pounds, and the men who build the big dams and bridges and who head the big steel companies and other heavy industries generally are little over five feet high. On the other hand the salesmen for men's haberdashery, writers of poetry, and laboratory research workers seem to have once been varsity letter men in crew or football.

All of which is brought to mind by the fact that Ed. Allen, who has to



sit on two pillows to see over the edge of the cowling and whose weight is doubled when he puts on a winter flying suit and parachute, is doing the flight testing of most of the new large transports and bombers, including some of the world's largest airplanes.

Probably the flivver planes are flight tested by men who need shoe horns to get themselves through the doors.

» ACCORDING TO THE NEWSPAPERS test flights have been completed in England on the two separate units of the Mayo Composite seaplanes and tests of the combination are about to be started. In case you are not familiar with this development, the scheme is to have a small heavily-loaded trans Atlantic seaplane and a large lightly-loaded seaplane attached together for the take off and after sufficient altitude and speed has been attained the smaller ship detaches itself and goes on its way.

If this innovation is successful and is used on the regular trans-Atlantic service we can imagine the pilot of the large launching plane complaining at home to his wife about the monotony of his existence—"Take off, climb and land again all day long, and never get anywhere!"

» AND, carrying this Mayo Composite airplane idea a little farther in the near future we can expect to see ten or twelve flivver airplanes roosting on the wing of a large transport for delivery to distant customers, just as automobiles are delivered from the factories today.

» WITH NEUTRAL SHIPS BEING BOMBED in the Mediterranean Sea, foreign owned enterprises being destroyed and flag draped neutral cars being machine-gunned in China, all entirely "by accident" and "because of mistaken identity" we are beginning to see what pilots mean when they ask for better vision in airplanes.

» ALONG THIS SAME LINE we note that the radio-controlled pilotless robot airplanes which Great Britain developed for use in anti-aircraft practice have been released from the secret list so that all nations will probably be using them. As the "vision" for anti-aircraft gunners might be as poor as for flying gunners and bombers it would be well for commercial airplane designers to carefully avoid similarities with these robot targets.

» NOW that the regular passenger service between Baltimore and Bermuda is about to start operations we, er-ah, hesitate to bring up the subject again but, ahem, now, about this job of ticket agent in Bermuda . . .

» MANY INDUSTRIES AND PROFESSIONS, banking being a notable example, have numerous holidays celebrating everything from Independence

Day to the start of the World's series, whereas aviation, being a much younger industry, doesn't have a single one. To fulfill the crying need for some special legal holidays for aeronautics, we'd suggest that the first one be set for the official opening day of the pheasant shooting season. As the far corners of the flying fields are popular living quarters for pheasants, all pilots, mechanics, dispatchers and airport managers are out in full force at the crack of dawn. We've seen some fields where they were so thick they might have been mistaken for WPA workers except that they were moving around instead of leaning on shovels. We contend that that day might as well be declared an official aviation holiday as there's no work done anyway.

Bell's Airacuda

AFTER FAGG—WHAT?

It was with a real sense of regret that we heard of Fred Fagg's impending departure from the Bureau of Air Commerce. We have been following Bureau affairs rather closely over the past three or four years and know something of the contrast between internal conditions today and what they were when Fagg took over from the former administration. Not that he has been able to "rear back and pass a miracle" to create the perfect government bureau in the space of a few short months. But out of the chaos of conflicting ambitions and petty jealousies that had been the rule rather than the exception when he inherited the job he has succeeded in building up an *esprit de corps* that was entirely lacking before.

To be sure, the reorganization program announced last spring is not yet complete, but all those present have shown a commendable willingness to work together as a team. It has been the Director's aim not only to co-ordinate the work of all his subordinates, but also to keep each department head fully informed of the problems and progress of other departments so that each feels that he is an integral part of the whole.

Naturally, all hasn't been "beer and skittles" for the Director. Undoubtedly Fagg has many times found himself blocked by political obstructions both from above and below that have irked him no end. But we

doubt seriously that troubles of this sort were the primary reasons for his decision to leave the Bureau. He is a man of too broad gauge to let such things get him down. After all, no one expected that he intended to make a career of the Directorship (even if such a thing were possible under any politically conscious regime), and, when a good opportunity came along, one that was eminently fitted to his tastes and ambitions, it was only natural that he should accept it. Fortunately, his new assignment will not take him away from the Bureau immediately, but will permit his remaining in Washington long enough to see through a number of jobs that he has already started. It is obviously his personal desire to hand over to his successor a smooth running and efficient organization.

Who that successor is to be, however, is still very much of a mystery. We feel that the administration will be making a very grave mistake if some positive action on that score is not taken immediately. Certainly by the first of the coming year a new Director should definitely be named, and he should function as right-hand man to Fagg during the months that he remains in office. If such action is not taken the administration will simply be duplicating the circumstances that surrounded the Vidal appointment in 1932 and we will again be in for a period of political finageling that will speedily undo all the good work that Fagg has accomplished in the past year. Already a goodly list of competitors is in the field. Political connections are being strengthened, and knives are being sharpened for an orgy of throat slitting that may easily make the last Battle Royal look like a Methodist picnic. The Powers can prevent it if they will. Let them name a good man forthwith, so that the work of the Bureau may go on without any unnecessary interruption.

THE MARITIME COMMISSION REPORT

On November 15 the long awaited report of the Maritime Commission was presented to the Congress. Of particular interest is the section on over-ocean aviation prepared under the direction of Grover Loening. Elsewhere in this issue (in the AVIATION NEWS) will be found some of its details.

Three phases of the report seem to us to merit particular attention. In the first place, it is recommended that the way be left open for competition in the development of the highly important trans-Atlantic air routes. With all due respect to the great progress that has already been made in over-ocean flying, the feeling is that the art is still so young that it would be detrimental to the public interest to restrict future development by the granting of monopolies of any sort at this time.

In the second place, we are glad to see that lighter-than-air craft will probably not be excluded from consideration in the building up of our over-ocean air transport. As we pointed out when the *Hindenburg* went down, we believe that it would be a definite mistake to overlook the possibilities of the airship in spite of the fact that most of the experience to date has been negative. At least their possibilities should be exhaustively explored before tossing them completely aside.

Finally, we can't overlook the fact that if the Maritime Commission's recommendation that it be granted supervision over foreign air transport is acceptable to the Congress, we are faced with the introduction of another agency into an already over-complicated picture. To the confusion that has resulted from un-coordinated effort of the Post Office, the Interstate Commerce Commission and the Department of Commerce to control American aviation must now be added another element, the Maritime Commission. That, certainly, won't tend to simplify matters any. But perhaps in the end it may prove to be a good thing. If too many fingers get into the pie it may occur to some one that the only sensible "out," after all, will be some sort of permanent federal commission to direct and to coordinate all our aviation effort.

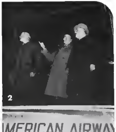
A NEEDED REFORM

For some time past the National Aeronautic Association has been plugging for an idea that seems to us so eminently sensible that we wish to add our endorsement and to urge the industry to give the matter some serious thought and some active support. We refer to the proposal for the establishment of standing committees on civil aviation in both houses of Congress.

Too often in the past few years we have seen what happened to aviation affairs on the Hill. Matters that should be treated with respect by legislators with at least some rudimentary knowledge of what they are all about, get tossed around from one committee to another, usually ending up in the hands of someone who has discovered that there is no better way of making the front pages than by having his name associated with anything to do with aviation,—no matter what.

The only way things of this sort can be avoided in the future will be by the appointment of permanent committees on aviation affairs made up of men who have the real interests of aviation development at heart and who have the time and the incentive to study the problem and to become reasonably expert themselves on matters pertaining to the air.

Practically all other phases of national affairs have their special committees in Congress and, certainly, aviation has become important enough in the national scheme to rate similar attention. Without some source of permanent interest it will be just as futile to expect anything to come of the recommendations of the industry or of special commissions of experts in the future as it has been in the past. The setting up of standing committees on civil aeronautics in both the Senate and the House of Representatives is a first and a highly important step toward the formulation of a sound national policy for aviation.



1 Donald Douglas does a little ceremonial paper work to mark the reopening of the Northrop plant.—Wide World

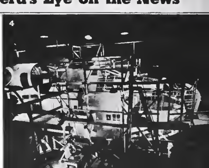
2. Pan American's John Cooper shows the French Line's Morin de Linclays and Air France's Marcel Olivier around the Port Washington, L.I., base.—Wide World

3. Air France tries out a new 24-passenger Lioré 246 Flying boat for its Mediterranean services.—Wide World

4. Night Life of a Clipper—Work rushes forward on the first Boeing 314, due outdoors in December.

5. Jimmie Doolittle gets a new Seversky Executive and the old Seversky hand shake.

Camera's Eye on the News



"Here Goes NOTHING!"

—a dangerous state of mind for the test pilot—or for anyone else who pushes a stick. How flight testing has progressed from the daredevil days into the realm of scientific research is told by

Edmund T. Allen

one of the country's foremost engineering pilots who is now in Seattle testing the Air Corps' long awaited "Project A" (the Boeing XB-15). Recently he put the first of the Navy's Sikorsky "flying dreadnoughts" through its paces off Bridgeport.

In the early days of aviation every flight was somewhat in the nature of a test flight. And it was a test typical of a period happily behind us, a period of knowing very little and guessing very much about how the airplane would behave once it got into the air under any given set of conditions. The test pilot flew a new craft of those days to see what would happen. He took the attitude "Well, here goes nothing," and was a bit surprised if his demands upon the craft were met safely. It was the era of the daredevil. The pilot was a kind of being different from all normal, thinking, planning creatures. He was not supposed to know what it was all about. Let the plodding engineers figure their lift coefficients; he was a man of the element "ether," born to soar aloft and escape death by a hair, nonchalantly.

Many of the early accidents in testing can be traced directly to such lack of a careful attitude on the part of the test pilot, who usually relieved himself of responsibility by referring to himself as a "fatalist." In these early stages of the science of flying the pioneering spirit attracted the type of man who enjoyed hazards in a field where most of the factors were unknowns. As the unknowns gradually became quantitatively predictable, the increasing complexity forced a problem upon such non-analytical gamblers. The attitude of being one who takes risks for pleasure was no longer tenable because it obviously meant that one was not up to the job of coping intelligently with this complexity. Under the changing conditions of increasing knowledge, fatalistic risk-taking becomes ignorant recklessness.

Anyone embarked upon the business of designing and building experimental airplanes is easily set psychologically into a chance-taking mould. It seems so much simpler and more economical of time to go ahead and try out the craft in the air to see what will happen rather than to reason out, and to compute and experiment "in one's head." The development of the art of flight testing can be roughly divided into three periods or stages, which are psychologically if not always chronologically distinct. The first of these has been described as one when everything was uncertain—there seemed to be no other way to get an airplane built and on the market than to try it out with as big a flourish as possible and an emphasis upon the risks involved. There were notable exceptions, as the careful Orville and Wilbur Wright did a thousand times as much planning and investigating as they did flying.

At the second stage of test flying development certain procedure became standardized in design, such, for example as obtaining longitudinal stability. We no longer have to face a first flight with uncertainty as to whether the airplane will be stable or not. Stability of the design has been computed. A model of the airplane has been tested in a wind tunnel for stability and controllability. Finally a check has been made of the proportioning of the stabilizing elements in accordance with past best-practice.

At the same stage the properties of materials became more accurately known and methods of stress analysis so elaborated that exact yield points for wings could be predicted for such "punishment" as an airplane gets in pulling out quickly from high speed dives. The test program for flight tests came to consist of an elaborate determination of the niceties of control and stability quantitative performance, and stalling characteristics. This second period was characterized by an enormous enlargement in our store of data on the one hand, and an increasing tendency, on the other to avoid foolish risks by pre-thinking, by laboratory experiment, and by computation. This second period was even more a transitional stage in the development of an attitude of aviation people than it is the product of chronological progress. And it brought a demand for the type of test pilot who was bent on reducing his risks, and who was capable of a new investment of thought in planning for every emergency that might occur. Test pilots as well as designers were now expected to think ahead several moves in a chess game where each counter move might shift the situation into a new pattern.

At the third stage there definitely emerges a new attitude toward flight testing away from chance-taking altogether and toward a complete analysis of each problem that can be met prior to flight. This stage is the end-product ideally of the progress in the second stage where a compromise had to be effected between the cost of further investigation and the cost of insurance (often exorbitant), against the risks of "trying the thing out in the air." Those who are reaching for this attitude greatly decrease their risks by beginning their "testing" at the inception of the design rather than at the last minute when everyone from designer to production manager, is so tense that omissions are favored and mistakes difficult to avoid.

As was remarked above, in the earlier stages the designer-builder-salesman tended to favor this attitude of daredeviltry and to hold to it after the test pilot was already tending to become more scientifically analytic. Budget requirements frequently pushed the management of later days—as they sometimes still do today—back into the old pattern to call a halt on scientific probing and to get the aircraft into the air as soon as possible, ironing out its difficulties somehow after the unbearable suspense of finding out if it would fly was over. The old Fokker organization was typical of this class of attitudes, with Mr Fokker laying out the designs with chalk on the floor, flying the airplane the first time himself, then cutting and trying until he was satisfied with the "feel" of the controls. Scores of Sopwith airplane designs were laid out solely in this manner, Harry Hawker taking the risks that were cheaper than a mathematical department. Occasionally they would lose an airplane—as was the case with a new Sopwith which turned out "in the air" to be so tail-heavy and to have such inadequate elevator-controls that even with the throttle closed nothing could be done to keep the airplane from stalling at once. Hawker, doing all his testing without a parachute at that time, attempted half a dozen times to land the airplane, got the wheels on the ground at high speed or with the engine fully on, but could not slow up or cut the throttle without having the airplane "zoom." Finally he aimed at a tree so as to hit it with one wing and cut the switch just as he hit. Fortunately he survived. The relation between center of gravity location and stability was known at the time, and this accident, like so many others, was not owing to lack of knowledge but to lack of care.

It is, however, precisely the mark of scientific progress when these after-thoughts become on subsequent trials pre-thoughts. It is usually easy to see after any accident how it could have been avoided, how it should have been foreseen. There are very few mysteries any longer in aircraft risks.

The spin-chute is often a life saver for both plane and pilot. The above illustration is a type used by the N.A.C.A. flight test section in its exhaustive study of spinning

Spinning is a typical problem dealt with characteristically in each of the three stages. The typical method of those still belonging to the earliest stage was simply to put the airplane into a long spin, possibly on the first flight, and when the time arrived for desired recovery, say after ten turns, to fight one's way out as best one could, if one could. The second stage type of spin testing began with a determination of the factors entering into spin recovery, such as unblanketed vertical tail surface, effective control surfaces, disposition of weights along the axes of the airplane, and other less important factors. The provision of an adequate, carefully designed spin-chute was an essential at this stage. Any test pilot who attempts spin-testing or makes prolonged spins without a spin-chute still be-

(Turn to page 73)

MILAN *Shots*

Conspicuously absent from last year's aircraft show in Paris were Italy and Germany. This year at the second Milan Aero Exhibition Hitler's Swastika and Mussolini's Fasces practically stole the show. Scattered among familiar types, AVIATION'S correspondent at Milan spotted a number of new and interesting designs.

ITALY

1. In the medium bombing class, the Breda 82 with a total of 2,000 hp. from two Fiat engines. Span 21 m. (68.9 ft.); useful load 3200 kg. (7,055 lb.); top speed 450 km.hr. (279.6 m.p.h.).

2 The Cant. Z-506B by Monfalcone, a three-engined twin float torpedo plane, is built largely of wood. Fuselage is of monocoque type; wings have three box spars, the floats are of metal. Engines are Alfa Romeo radials of 770 hp. each. Span 25.5 m. (83.7 ft.); wing area 87 sq.m. (936.6 sq.ft.); weight empty 7500 kg. (16,500 lb.); gross weight 11500 kg. (25,350 lb.); top speed 390 km.-hr. (242.2 m.p.h.) at 4000 m. (13,000 ft.).

3. The Nardi F.N. 305 two-seater is built entirely of wood. Engine is an Alfa Romeo of 185 hp. Span 8.5 m. (27.9 ft.); wing area 12 sq.m. (129.6 sq.ft.), weight empty 620 kg. (1,367 lb.); gross weight 900 kg. (1,918 lb.); top speed 325 km.hr. (202 m.p.h.); normal range 780 km. (485 miles).

4 The Lombardi L/B resembles the American Stearman-Hammond. Engine is a 120 hp. Alfa Romeo. Span 11.7 m. (38.4 ft.); wing area 15.2 sq.m. (164.1 sq. ft.); weight empty 580 kg. (1,278 lb.); total weight 880 kg. (1,940 lb.); top speed 230 km.-hr. (142.8 m.p.h.); normal range 800 km. (497 miles).

5 Stelzmatti exhibited the S.S. 3 "tail-first" or Canard type, all wood, with a 35 hp. CNA engine in the rear of the fuselage. Span 12.8 m. (42.0 ft.); wing area 18.5 sq.m. (199.2 sq.ft.); weight empty 300 kg. (650 lb.); gross weight 520 kg. (1,144 lb.); top speed 140 km.-hr. (87.0 m.p.h.).

GERMANY

6. The Junkers Ju 86 K bomber is powered with two BMW engines of 880 hp. each and carries three machine gun positions. Span 22.5 m. (73.8 ft.); wing area 82 sq.m. (895.8 sq.ft.); weight empty 5,810 kg. (12,800 lb.); gross weight 8200 kg. (18,070 lb.); top speed 390 km.hr. (242.2 m.p.h.).

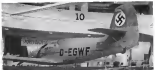
7. A retractable gun turret defends the stern of the Ju 86 K bomber.

8 The Heinkel He 112 single-seat fighter carries two machine guns in the fuselage and two cannons in the wing. Power plant is a 680 hp. water-cooled Junkers Jumo 210 inverted twelve-cylinder Vee engine. Span 9.2 m. (30.2 ft.); weight empty 1,600 kg. (3,520 lb.); total weight 2,230 kg. (4,900 lb.); top speed 485 km. hr. (301.3 m.p.h.) at 3,600 m. (11,800 ft.); normal range 1,100 km. (690 miles).

9. Detail of the Halle Fh 104 five-place cabin touring monoplane. Wings are wood, fuselage and tail surfaces of dural. Power plant two Hirth HM 508 engines of 240 hp. each. Span 12 m. (39.4 ft.); wing area 22.3 sq.m. (240.9 sq.ft.); weight empty 1,440 kg. (3,170 lb.); gross weight 2,250 kg. (4,952 lb.); top speed (sea level) 335 km. hr. (208.1 m.p.h.), normal range 950 km. (590 miles).

10 Designed for training is the Gotha Go 145 single seater. Construction is mixed wood and metal. Power plant is a 240 hp. air-cooled Argus As 10 C engine. Span 7.3 m. (25.8 ft.); wing area 11.4 sq.m. (122.1 sq.ft.); weight empty 740 kg. (1,630 lb.); gross weight 1,000 kg. (2,200 lb.); top speed 345 km.-hr. (214.3 m.p.h.), normal range 950 km. (590 miles).

Photographs and specifications by Fritz Wittekind, Berlin.



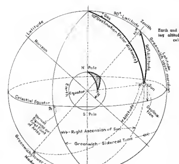


Fig. 1.
Earth and celestial sphere showing altitude, latitude, and the celestial triangle.

AIR NAVIGATION

Finding Your Way in the Air

IV. CELESTIAL NAVIGATION

By
Lt. Comdr.
P. V. H. Weems
U. S. N. Retired

CELESTIAL NAVIGATION is the method of determining position by means of celestial bodies. While this method has been in use at sea for centuries, its adaptation to air navigation is of course recent, dating back only about twenty years. In this short time, however, and due largely to the development of Air Navigation, both the concept and the methods have undergone radical changes. While space does not permit a detailed exposition of the method, it is the intent of this and the succeeding installment to explain the principles on which the method is based, and to indicate in a general way how it may be accomplished The reader may then judge for himself whether or not to take up the practical application of the method

In this discussion certain terms new to the beginner, but no more mysterious than such terms as "latitude" and "longitude", will have to be introduced. In defining these terms, principal use will be made of illustrations and a dependence on the common sense of the reader

Let us now introduce the special terms used by a careful study of Fig 1 which shows the earth and the celestial sphere with the navigation triangle outlined and with the essential definitions indicated Formerly, the celestial triangle was considered, but the latest practice is to consider only the hatched triangle on the earth, thereby simplifying the subject

The reader will note at once that the equator, poles, meridians, etc., on the earth have their counterpart in the celestial sphere Note carefully that the position of the sun or other celestial body may be projected to the surface of the earth and when so projected, the corresponding position on the earth is called the Geographical Position (G.P.) of the body.

Another important definition is that 1' of arc on the Earth is a geographical mile (6080.27 ft.), used in navigation. In fixing a position by celestial bodies, it is necessary to know the G.P. of those bodies at any instant of time. These data are found in the Nautical Almanac (or new British Air Almanac). The latitude (called Declination) and longitude (called Greenwich hour angle) of the G.P. of all bodies used are tabulated in the Almanac for suitable intervals of time, and the exact values for any desired instant found by interpolation. We are now ready to take up—

Celestial Navigation Theory

An observer at any point on the earth's surface, except the poles, sees the altitude of any heavenly body change with time. The altitude can be calculated for any instant of time by methods to be described later.

The altitude of a heavenly body also changes with a change in the position of the observer The amount of this change depends on the direction in which the observer moves relative to the geographical position (G.P.) of the observed body. If he moves one mile directly toward the observed body, the altitude is thereby increased by 1'; if he moves away, the altitude is decreased by 1'; while if he moves in any other direction the altitude is changed by a predictable amount.

The converse is also true, namely, that, if the altitude of heavenly body is known, the distance from the geographical position of the body for the instant of observation is known Celestial navigation is based on the application of this principle. Therefore we may say the work of the navigator in celestial navigation consists in finding his geographical coordinates of latitude and longitude by locating himself with reference to the geographical position of one or more celestial bodies

The exact position of a body, in terms of declination and Greenwich hour angle, may be taken from the Almanac for any instant of time, and this position may be plotted on a globe or chart as latitude and longitude A circle with this position as center, and with a radius equal to the observer's distance from this position as determined by the sextant (i.e. 90°—altitude), would be the observer's circle of position, the observer's position must lie somewhere on this circle If two bodies were observed, the intersections of the circles of position would determine the position (or two possible positions) of the observer

Since the circle of position as determined above would be very large, a small arc of the circle may be considered as a straight line, at some point on which is the observer's position If it were possible to lay off on a chart with sufficient accuracy the distance of the observer from the geographical position of the body celestial navigation would be easy. The observer would in this case doubtless use a sextant graduated to read zenith distance (instead of altitude) in minutes, or nautical miles, and this distance (90°—altitude) would simply be used as the radius of an arc to be laid off on a chart from the plotted position of the body Unfortunately, the great distances—up to 5.400 miles—to be plotted makes this simple and obvious method impracticable but the desired effect is secured by the means about to be described

The navigation triangle—In Fig. 2, which is a representation of part of the earth's surface, P is the elevated pole, Z the position of the observer and S the geographical position of a star These three points form the vertices of a spherical triangle ZPS which is known as the *astronomical* or *navigation triangle* The side PS is the polar distance (90°—declination) of the star, ZS is the zenith distance (90°—altitude) of the star, and PZ is the colatitude (90°—latitude) of the observer The angle ZPS at the pole is the local hour angle, and the angle PZS at the zenith is the azimuth or direction of the star The angle PSZ at S, which is seldom used, is called the parallactic angle

Solving the astronomical triangle—The quantities from which the astronomical triangle is usually solved are the sides PZ and PS, and the included angle at P The assumed latitude subtracted from 90° gives the side PZ, the declination subtracted from 90° gives the side PS The angle at P is the difference between the longitude of the body (geographical position) and the assumed longitude of the observer

By specially arranged tables the latitude, declination and local hour angle are used directly in solving the triangle for the computed altitude, which is 90° minus the side ZS, and

(*Turn to page* 74)

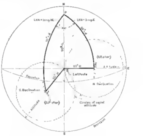


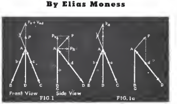
Fig 2. Navigation triangle and circles of equal altitude

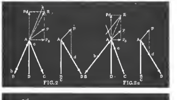
Solving SPACE STRUCTURES **Graphically**

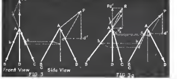
The graphical method outlined in this series of articles saves three-quarters of the time required for computation and the results are accurate to within one percent of computed values. It has been used extensively by the Douglas Engineering staff and can be applied generally to any space framework

Part 1

By Elias Moness







THE APPLICATION of graphical methods to the solution of space structures, i.e., of structures all members of which do not lie in the same plane, is difficult and often impossible. Yet, the graphical method is so much quicker and easier than the analytical method that it is very desirable to extend its use to space structures as well. It is the object of this article to demonstrate a method for solving any statically determinate space structure graphically.

Let us analyze the simplest of all space structures—a tripod such as is used for landing gears of smaller planes.

Case 1

Fig. 1 shows such a tripod with the load "P" applied at the apex. Note that two views are required to show the structure and the applied load. Resolve load "P" into two components: P_v in the plane of members AB and AC, and P_h normal to this plane. Since AB and BC cannot take any load which is perpendicular to their plane, it is obvious that P_h is taken entirely by AD; also, since P_h and AD are in the same plane, P_h is the horizontal component of the stress in AD, hence, we project P_h on AD and find Ad to be the stress in AD; this can be scaled using the same scale as the one to which "P" was drawn. Next, we mark the nature of the stress in AD by means of arrows (compression).

The members AB and AC must take care of the load P_v and also of the vertical component of Ad, hence we lay off a vector equal to $P_v V_{Ad}$ (vertical component of stress Ad) as shown and find the stresses in AB and AC in the usual manner; finally, we mark the nature of the stresses (tension) and scale off their magnitude.

An examination of Fig. 1 will show that instead of resolving "P" into components, we could have solved the side view as if it were a plane structure consisting of two members only, (see Fig. 1a). Ad is found by drawing Pd parallel to ABC, and has, of course, the same value as before; the phantom member ABC has a tension equal to Pd; hence, we apply a tension load Pd to the structure in the other view and solve; again we mark the nature of the stress and scale.

Note that the original applied load in the front view is ignored when we apply the phantom load Pd. Care must be taken to apply a tension load, if the phantom member ABC is in tension.

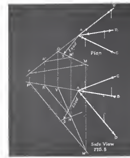
The case just analyzed is a special one:

1. The load "P" is in the plane of the paper in side view.
2. The structure is symmetrical in the front view.
3. AB and AC are in the plane of the paper (side view is vertical).
4. AD is also in the plane of the paper.
5. AB and AC are superimposed on each other in side view.

Case 2

In Fig. 2 condition 1 is eliminated by using a space load, i.e., by giving the load "P" a side component. To solve this case we proceed as before till we apply Pd in the front view. At this point we must take into consideration the side component P_s. This we do by combining Pd with P_s in the front view. This gives the resultant R. We then proceed as usual.

In Fig. 2a condition 2 is eliminated by making the structure unsymmetrical in front view. The method of solution is the same as above. Note that only the side component of P in the front view is combined with the phantom load and not the whole load P. This is so because the vertical component of P has already been taken care of in the side view.



Case 3

In Fig. 3 condition 3 is eliminated by inclining the plane of AB and AC so that they are no longer in the plane of the paper in any view (AD is still in the plane of the paper in side view). We obtain Ad by drawing through P a line parallel to ABC. But, since the front view shows only the vertical projection of AB and AC, we must apply not the entire phantom load Pd, but only its vertical projection Pd'. Solving then the front view in the usual manner, we obtain not the true length of the stress vectors, but only their vertical projection. These vectors cannot be scaled directly. We must revolve them into the plane of the paper and after thus finding their true length, we can scale them.

The complication introduced by the fact that the plane of AB on AC is not vertical, is that we must deal with projections and finally find true lengths by rotation of the vectors.

Fig. 3a shows the same case for a space load and an unsymmetrical structure. Note that both tension vectors had to be revolved since they are of unequal length.

Case 4

In Fig. 4 condition 4 is eliminated by slanting member AD away from the vertical plane. Now none of the members of the tripod is shown in true

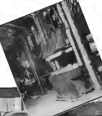
(Turn to page 78)

Producing the Ryan S-C

By T. Claude Ryan
President Ryan Aeronautical Company

How manufacturing methods have been developed in conjunction with design to simplify metal plane production problems through utilization of the drop-hammer forming process.

Flight Photos by C. F. McReynolds AVIATION



Showing part of the battery of four drop hammers on which most of the Ryan S-C parts are produced.

Master plaster model of Ryan S-C cabin plane being used for development of forming dies to produce bulkheads and double curvature skin sheets to be formed on the drop hammer.

Master fuselage jig for cabin portion in foreground. Rear portion being attached is formed separate from this jig. Completed fuselage structure in background.

FROM THE TIME we first decided on the development of a metal cabin plane, the Model S-C was designed and engineered with the principal objective of introducing a high performance aircraft for private business and pleasure operation which would be capable of taking full advantage of the production possibilities of metal construction.

The plane was planned from the first preliminary drawing as a production job. We wanted to develop a type of construction so simple and so practical that it would lend itself to efficient manufacture in much larger quantities than have been customary in the past.

Aircraft designers have for years toyed with the idea of airplanes stamped all at once in one huge press, or poured out of some synthetic material in a single molding operation, or somehow fabricated so as to avoid the tedious hand fitting of limitless numbers of small parts. We believe that in the development of the new S-C we have approached this ideal of the one-piece airplane.

It all started with the development of the S-T metal-fuselaged sport trainer which went into production in 1934. Four years of manufacturing experience with metal planes, plus the quantity production during the same period of a wide variety of metal parts on contract for other airplane manufacturers, have given us the opportunity of fully developing the application of metal construction to the small airplane.

Our basic effort was to develop a design in which the number of individual parts was held to the fewest possible, the elimination of hand fitting, and the minimizing of riveting and costly assembly operations. It is a much more difficult assignment to simplify a structure than to "complexity" it. But by extensive study, experiment and ingenuity we have gradually evolved the design of the S-C to the point where, as it is now in production, we feel it is the most simply manufactured metal airplane, and the most adaptable of any yet developed to an efficient production system in fairly large quantities.

Such simplification and elimination of hand fitting requires precision manufacture. Precision manufacture of parts made of aluminum alloy sheet could be economically achieved in only one way—by stamping them all out with the same die, and that is essentially what we have done.

The Ryan S-C cabin plane is almost entirely of 24ST Alclad aluminum alloy sheet construction. And every part of it, with few exceptions, is either a flat sheet, or a drop hammer stamping. Flat sheets are all marked and drilled from master steel templates, and stamped sheets are all formed from dies which accurately reproduce a given part exactly over and over again.

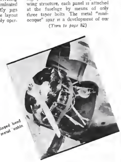
In the S-C design we have reduced the total number of parts in the plane, reduced the amount of riveting required to assemble it, eliminated completely most of the costly jigs ordinarily required, and made layout and alignment time on assembly operations unnecessary.

The S-C fuselage closely follows S-T practice, the forward portion being assembled on a precision jig, while formed alloy sheets are riveted to built-up bulkheads which tie the fuselage structure to the main wing spar and engine mount. As on the S-T, the after portion of the fuselage is a simple monocoque structure of cone form, shaped from flat alloy sheets without compound curves. These sheets are easily riveted to the shape of the fuselage after layout of the sheets from master templates. The somewhat floppy sheet metal cone is then developed into a sturdy fuselage structure by riveting the bulkheads in place. This is all done without recourse to any jig, as the layout from master steel templates assures perfect alignment, although all rivet holes are reamed before final riveting of bulkheads to the sheet.

From the cabin rearward, the fuselage is a true monocoque structure, and is assembled to the cabin section in a master jig, all other operations on the fuselage structure assembly being performed with assembly jigging eliminated.

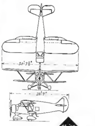
The wing is similarly simplified to obtain the maximum advantage from the precision drop-hammer die-stamping process. With a monospar type wing structure, each panel is attached at the fuselage by means of only three taper bolts. The metal "monocoque" spar is a development of our

(Turn to page 82)



Automobile-type hinged hood for new Ryan metal cabin plane.

AVIATION



More about that

WACO 3-Wheeler

Hugh Perry discusses some of the advantages of nose-wheeling and reveals a few details of construction and performance.

Flying Equipment

ONE OF THE OBVIOUS advantages of any three wheel gear is, of course, the excellent visibility on the ground at *all* times At no time in take-off or landing is visibility sacrificed for an instant Next, of course, is the naturalness of the operations of take-off and landing for a novice. While taking off the pilot remains in a level-with the ground position (as he would if driving down the runway in a motor car) until the airplane is ready to leave the ground In landing, large flaps (such as those fitted on the Waco N) permit him to approach the very edge of the flying field and point the airplane directly toward the spot he selects It is practically impossible even for the novice, to build up dangerously excessive speed in this maneuver As he approaches the ground it is natural to decrease his angle of approach and level off, but he does not have to put the airplane in an attitude beyond level flight with the nose pointing skyward. On the contrary, he resumes the natural level-with the-ground attitude at which he took off.

In leveling off above the ground the wings are at approximately zero incidence and there is no tendency for the ship to balloon back in the air and the hardness of the drop is completely absorbed by long oleo wheel travel of the three wheels If the front wheel hits first while there is a slight bounce, again there is no positive incidence and the airplane bounces only to level position and settles on all three wheels.

Lastly, if (usually by an experienced pilot) the rear wheels are put down first and an old style conventional three point landing is made, the ship rocks forward at once without undue shock onto the third front wheel

Another obvious advantage of this gear is, of course, the inability of the most awkward or inefficient pilot to put it over on its back—at no time is the pilot required to do the delicate job of balancing the airplane and load on two wheels Extensive testing has indicated that the directional stability of our three-wheeler on the ground is good at all times This is inherent with a gear with the front wheel free to castor and not steerable Above speeds of fifteen to twenty miles an hour the airplane cannot be turned sharply, no matter if a positive effort is made Ground looping is, therefore, completely eliminated and crosswind landings and take-offs present no problems. Below these speeds steering may be accomplished with ease

AVIATION

The Model N-8 Waco follows quite closely the conventional Waco biplane design of the later cabin series The fuselage is of welded aircraft tubing with a removable motor mount, the structure is wood-faired for shape and fabric covered

The wings are of wood construction with spars of aircraft spruce and built-up ribs of spruce with mahogany plywood gussets, the spars are separated with duralumin compression tubes and double braced with Breeze internal tie rods, wing tips are finished to a near knife edge Ailerons are of the same design and are provided on upper wing only, flaps of duralumin are provided and are vacuum operated from a single tank located in the fuselage assuring simultaneous action on all surfaces The entire wing structure except flaps is fabric covered

Horizontal and vertical stabilizer surfaces are likewise of wood structure, the horizontal stabilizer being first covered with plywood and both units then fabric covered. Elevators and rudder are of welded aircraft tubing fabric covered.

The cabin interior is trimmed with Laidlaw broadcloth The rear seat is solid with individual belts for two The front seats are individual and are adjustable. Great attention has been given the design of all seats to insure comfort on long trips

Brake pedals operating oversize hy-

(Turn to page 77)

Martin Ocean Transport

Wing structure before covering

10,000 lbs. of payload in a long range flying boat

THE AIRLINE OPERATORS are justified in wanting to make money Today, that is beginning to be no trick at all for the fellow who makes five or six hundred mile jumps between stops But the operator who has to fly across an ocean soon finds his largest cargo is gasoline and the number of gallons per passenger quickly reaches appalling proportions After a while it begins to get on his nerves He may be led to dream about gasoline in his frequent nightmares, or to decorate his den with unattained specific fuel consumption figures.

To this practical problem the Glenn L Martin Company has devoted much time and research The goal is commercially profitable over-ocean transportation by air To approach that goal Martin has considered all of the practical problems in the light of their past experience They have developed and built an aircraft that will support itself as well on the account books as it does in the air

The first job was to fly long distances non-stop over water with regularity and reliability This has long since been accomplished and is now being done with Martin equipment. The next job was to fly over the same long distance with a sufficient load of passengers or freight to pay some profits to the stockholders. That too has been done with the more famous Martin products—the China Clippers But the final job is to increase both the range and payload That has been done in the new Martin ocean transport, Model 156

Although the new Ocean Transport represents an important forward step in large flying boat development, it is most conveniently described in terms of its illustrious ancestor, the China Clipper All of the features that have withstood the tests of time and service have been retained and many notable improvements have have been added The elements of design contributing to operating efficiency and load carrying capacity have been substantially refined

The most striking comparison of relative efficiency lies in the respective pay-loads of the two Martin models over the same route From San Francisco to Honolulu the China Clipper series have a payload capacity of about 2,500 lb The new Martin Ocean Transport on that route can carry in excess of 10,000 lb payload—and at high speed Thus, has the next step in our ocean transportation been taken

Generally the new ship resembles its predecessor in that it is a braced monoplane flying boat with lateral stability when afloat provided by Martin seawings. The most striking difference in appearance is furnished by the twin rudder tail This departure from previous practice improves control in flight, particularly with one engine stopped.

Modifications in the hull are few but are of great importance No changes have been made in the general construction and the passenger accommodations are the same excepting an increase in the number of sleeping berths from 18 to 26 and the inclusion of an additional toilet compartment But the fuel is no longer carried in integral tanks between the cabin floor and hull bottom It has been moved outside to the seawings, leaving passengers free from the possibility of fumes penetrating into the cabin space.

Hull lines in general are similar to that of the earlier ships, but up in the bow the chine flare has been relieved with no detrimental effect indicated in water tests and with definitely reduced drag. A weight saving has been affected by the substitution of the Northill type of anchor. Another important modification in hull form is found in the tail The slab sides of the Clipper have been replaced by curved surfaces resulting in an elliptical section increasing the space for storage of light materials and providing two crew bunks instead of one But the most valuable feature of the increased section area to the operator is that it makes it possible for a man to go back to the tail tip where he can reach the mooring hatch located there or inspect the structure and controls at the after perpendicular.

Widening of the cabane structure forward has greatly improved the accommodations for the flight engineer The position of the two pilots' seats has not been changed but the radio operator has been moved down into the lower level space just forward of the ladder leading up to the pilot's compartment. This leaves space for a navigator's post complete with chart board, cabinets, and observation windows in the forward portion of the cabane. Farther back is the office of the flight engineer with its private entrance hatch on the port side and a compact but complete instrument panel to the starboard. The flight engineer's seat is mounted on a track and can be moved back and forth in the extreme rear of the cabane In addition to his other duties this officer is in a strategic spot to inspect the control cables which pass out of the cabane into an external duct at a point just ahead of his seat. Thus the control cables by-pass the passenger cabin and their examination is possible without disturbing the soundproofing of the interior They return to the interior of the hull at the rear companionway.

Changes in the wing are more aerodynamic than structural and it is here that the remarkable increases in efficiency are obtained. The increase in aspect ratio from 7.80 to 10.75, the close approach to elliptical plan form, a change in airfoil section from a modified Gottingen to the N.A.C.A. 23 000 series, and the addition of flaps are the essential differences between the old and new models Because of the longer span

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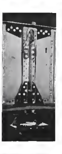
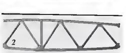
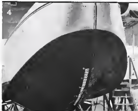






1 Wing beam splice and attaching fitting at center of ship

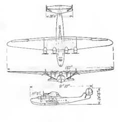
2. Center wing rib

3 Aileron structure showing hinge rib Torque between hinges is entirely carried by the leading edge box structure

4. Draft marks at the bow suggest the approach to the ocean liner

5. Flap control mechanism on rear beam

Structure of tail showing the new elliptical section



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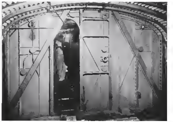
TEXACO *Aviation* **PRODUCTS**



Hull bulkhead in plane of wing attachment

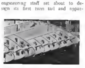
and the elliptical form there is less damping in yaw and better control is obtained. Ailerons are much smaller than those of the China Clipper Tabs and servo controls are provided but may not be neces sary because of the generally improved control

An important feature of the specially designed flap is the "Anti-drag" shutter The opened shutter closes the gap between the lower surface of wing and flap when the latter is in normal position In the first degree of downward flap travel the shutter moves upward, completely opening the gap

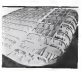
A number of refinements have been made in the wing structure but it is of the same general type as that of the earlier model Detailed changes in the rib construction are shown in the accompanying illustra tion A new feature is the water-tight compartments in each wing tip useful in the remote event of damage to the seawings Covering is corrugated on top and flat on the bottom with flush riveting used only at the critical leading edge areas

The seawings have been cleaned up considerably. Their bottom surfaces are the same as in the earlier model and are corrugated The flat upper surface has been faired to approximate the 23,000 series of airfoils Basic research dictated the changes that have been made in vertical position, dihedral, incidence and span Each seawing has two gasoline tanks, one of 870 gallon capacity, the other of 1,260 gal From these the fuel is pumped into two 100 gallon service tanks in the wings Accessibility of the fuel and wobble pumps has been improved by moving them up out of the bilge into a forward compartment to the right of the galley

Wind tunnel tests on a scaled-up version of the Clipper tail showed the desirability of improving the control characteristics so the Martin engineering staff set about to design its first twin tail and apparently it has turned out very satisfactorily



Sea wing construction providing integral tanks of 4260 gal total capacity



Inverted view of seawing under construction showing the web type girders that serve as baffles for the integral fuel tanks

Licensed under Reid patents, the new tail is of particularly clean design Its normally high aspect ratio is increased in effectiveness by the end plate rudders The vertical area has been increased without any increment in horizontal area but the efficiency of the horizontal tail is much improved. Invaluable for maintenance and operation are the retracable steps in the fin and handgrip near the leading edge of the horizontal surface

A good many engineering hours could be spent in designing for the installation of four G-2 Cyclones in a flying boat of this type and the complications that might result were foreseen by Martin engineers far in advance of the initiation of construction Accordingly, a test nacelle was built so that the details could be worked out between the engineering department and the factory. The result of a good many hours of testing in the test nacelle has been one of the cleanest power plant installations we have seen not only from the standpoint of original installation but of operating maintenance Far from the customary clutter of the usual space behind the engine, the installation gives one the immediate impression that it would be very much easier to work on than the average automobile.

To improve the general accessibility of the engines, extensions have been added to the eight folding servicing stands in the leading edges of the wings. These extensions are completely detachable and are used only when it is necessary to get at the front end of the engine or the propellers Provision is made for the attachment of tripod hoists to the wing spars for removal of propellers or heavy parts of the power plant

The propeller plane has been moved forward to reduce interference of the wings and 12 foot, three-bladed Hamilton Standard constant speed types with Quick brakes and slinger rings are used Nacelles are a modification of the bomber type with N A C A cowling and Vought type cowl flaps A flap angle of 45 deg however was found better than one of 20 deg for the cowl Solar exhaust manifolds and Lord mountings have been used in the engine installation An entirely new application for the Cuno oil filter has been found in the hydraulic system.

Because of its proportions the

(Turn to page 82)

Two New Cubs

Sport and Trainer Models Embody Many Improvements

Flying Equipment

MANUFACTURERS OF THE PROLIFIC Cub at Lock Haven, Pa., announced at their annual Distributors meeting, Nov. 10 a new series of models to be known as the Cub "Sport" and Cub "Trainer." Although basically the same as the J-2 in outward appearance the new Cub Sport reveals more than fifty major and minor improvements, within and without. The exterior has been greatly changed by the addition of a new rudder and fin which add greatly to the directional stability of the ship. The fin has been more than doubled in size and faired into the fuselage.

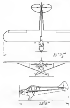
Construction of the "Sport" is the same. Steel tube fuselage with fabric covering and spruce spars with metal ribs for the wing are the same as before. Whereas before the Cub was made a cabin ship by adding enclosures, the cabin of the Sport is an integral part of the fuselage, allowing complete weather proofing of windshield and windows. The cabin itself is completely upholstered on sides top and rear and is backed by doped fabric to prevent stretching of the whip-cord cloth. Except for the rudder cables, all other control wires are run beneath the floor.

The length of the cabin has been increased seven inches allowing considerably more leg room for occupants of both seats. The rear seat, which is of hammock type, extends the full 26 in. width of the cabin. The front seat made up of welded tubing is wider and deeper. Both seats are deeply upholstered according to latest automobile specifications.

The stabilizer control mechanism is now actuated by a crank on the left side of the cabin. The wire cable which connects with the stabilizer may be adjusted for tension by a snub up pulley accessible through an inspection window. The instrument panel has a central insert which allows the addition of extra instruments without cutting into the panel itself. When airspeed, compass or both are desired, an insert with one or two holes supplied replaces the central part of the board. Gasoline shut off and ignition switch are recessed in the upholstery on the left side. The left hand window slides up and down in inside the upholstery.

Baggage allowance on the new ship which has been issued a separate ATC is raised to 20 lb. with an over-all gross load of 1,000 lb. Wings are wired for navigation lights, and roller bearing wheels and hand rub finish are standard. Different fairing of the top deck and addition of stringers on the side of the fuselage materially increase the speed of the Sport which is available with either the dual or single ignition Continental A-40.

The Cub Trainer is basically the same as the 1937 J-2. Standard equipment now includes enclosure, roller bearing wheels and over-sized tires.



Specifications

Length overall	22' 5"
Height overall	6' 8"
Wing span	35' 2½"
Total area	178 sq. ft.
Chord	5' 3"
Weight empty	574 lb
Useful load	426 lb
Baggage allowance	20 lb
Cruising speed	76 mph
Top speed	88 mph

Improved interior of the new Cub Sport

Aircraft Radio

New Equipment for Communication and Navigation by Henney and Fink

Bendix Announces Two New Receivers for Communication and Beacon Use

Word comes from W. P. Hilliard, Bendix vice president in charge of engineering at Chicago, of two new aircraft receivers, the RA-2, intended for communications use, and the RA-4 for beacon signals, also a direction-finding anti-static loop.

The RA 4 Beacon Receiver is an 8-tube superhet, using one r-f stage and two i-f (157 kc.) stages, covering the range from 195 to 415 kc. continuously. A relay-operated tuning switch is built into the receiver for the purpose of automatically tuning the set to the fixed frequency of 278 kc., by simply throwing the control switch. Manual sensitivity control and automatic volume control are provided. The receiver has two entirely separate audio channels, so that either of two pilots may use the receiver independently. Iron-cored inductance coils are used in both r-f and i-f circuits.

The beacon receiver weighs only 14¾ pounds with tuning drive and tubes, a low weight made possible in part by the use of 17ST dural chassis, panel and cabinet. All the electrical connections, including antenna and power supply, are made through a single plug on the front of the receiver. The power supply required is 1.3 amps at 12 volts and 45 milliamps at 200 volts. A feature of the receiver is the flexible shaft tuning drive, which operates through a 264-to-1 reduction gear. This gear contains a rotatable drive-head at the panel which can be rotated in steps of 30 degrees to accommodate the angle at which the flexible shaft approaches the set. This avoids kinks and simplifies installation. Octal base tubes are used (type 6K7G r-f, 6C5G oscillator, 6L7G first detector, 2-6K7G i-f, 6R7G second detector a-v-c and driver, and 2-6K6G double audio output). The receiver will deliver 500 milliwatts from a signal of 1 to 2 microvolts, and provides a selectivity 80 db down at a bandwidth of 9.25 kc. at 200 kc., 80 db. down at a bandwidth of 11.2 kc. at 400 kc.

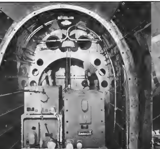
The communications receiver, type RA-2, is designed for voice communication in the band from 2600 to 7000 kc., in which any 8 pre-selected frequencies may be chosen. The set is a 10-tube superheterodyne, the line-up being the same as that of the RA-4 except the 6R7G tube is replaced by a 6H6G and a 6C5G, and that a 6K7G is used as an a-v-c amplifier.

The tuning circuits employ air-dielectric trimmer condensers, which are switched by the same shaft as the coils. Each antenna coil is provided with five taps which allows accurate matching to the antenna at each of the eight pre-selected frequencies. The r-f stage is double-tuned, while the oscillator is designed to operate crystal controlled, using low-temperature coefficient units. An untuned coil, used in conjunction with each crystal is placed in the cathode circuit of the oscillator tube. Iron-cored inductance coils are used throughout the r f, i f systems.

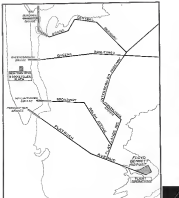
The a-v-c system, of the delayed amplified type, will hold the output constant within 3 db. while the input varies from 1 to 100,000 microvolts. The manual sensitivity control is applied to all but one of the a-v-c controlled tubes. This latter tube thus limits the output at the upper limit of signal strength, regardless of the position of the manual control. As in the RA 4 receiver, duplicate audio channels are provided for use by two pilots.

The switching of the pre-tuned circuits is accomplished by a motor driven control, which drives the rotary switches in the receiver. The eight frequencies may be arranged separately or in groups of two, with an auxiliary switch for selecting either of each pair.

The weight, including tubes and 8 crystal units is 23 pounds. The power consumption is 1.6 amps at 12 volts and 65 milliamperes at 250 volts, the latter figure at maximum sensitivity.



Left, Bendix receiving unit mounted in Northwest Airlines' Lockheed 14. Right, the new anti-static loop, mounted in the nose. The loop and loop drive weigh 5 lb. 3 oz., the loop amplifier and its control unit bring the total weight to 11 lb. 4 oz. It is designed for use in the 180 to 410 kc. band



Buyers' Log Book

What's New in Accessories, Materials, Supplies, and Equipment

Chambersburg Cecostamp

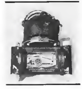
Stamping machine forms light alloy sheet parts.

WIDE APPLICATION of the Chambersburg Cecostamp to aircraft manufacture is reported by the Chambersburg Engineering Company, Chambersburg, Penna. Available in sizes ranging from 41" x 36" to 120" x 120" on the working face of the anvil and ram, the Cecostamp may be operated from normal shop supply of compressed air, ranging from 75 to 100 lbs pressure Of rugged construction, the Cecostamp is an air operated power hammer with very sensitive control It was originally developed to take the place of the rope lift type hammer The manufacturers also claim that many operations performed on the hydraulic press can be handled economically by the Cecostamp

The Cecostamp was designed to accommodate the lead and zinc dies originally used in connection with rope lift hammers The desirability of these dies is due to their low first cost and to the fact that nearly all of the material from which they are made can be salvaged and used again in the making of new dies

Some of the aircraft parts now made by this equipment in a number of aviation plants are instrument panels, wheel fairings, exhaust stacks fuselage rings, wing tip ribs, channels and fittings —AVIATION, *December, 1937*

1—Cecolly cast Cylinder; 2—Patented safety cover; 3—Adjustable I-beam frames; 4—Rotary throttle valve; 5—Cast steel frame; 6—Cecolloy anvil; 7—Sensitive ram control; 8—Pneumatically operated safety pedal.



Slinger Ring Feeder

Slinger Feeder

Pump meters prop de-icer fluid.

DESIGNED in conjunction with airline engineers to meet the particular problems of feeding de-icing liquid to the propeller slinger ring, cockpit windshield, and loop antenna, a de-icer liquid metering pump has been placed in production by the Thos L. Siebenthaler Mfg Co., Kansas City, Mo—AVIATION, *December, 1937*

Degreaser

Chemical treatment for airplane parts.

"DUNK IN GUNK" is the slogan we suggest for the The Curran Corporation, Malden, Mass, manufacturers of "Gunk", a degreasing compound for use in cleaning airplane parts and said to be approved for use with aluminum The makers state that it is a water-in-oil type of solvent emulsion and that the work is simply immersed in a cold bath aided by agitation creating turbulence to scour the work. After immersion the work is removed and the excess Gunk is drained back into the tank. The parts are then rinsed off with a water hose and the Gunkified substances flush away into the sewer, or what have you Since Gunk does the work cold the danger and inconvenience of pro-

viding an open flame, or steam for heating the cleaning solution is avoided. Extra long bath life is reported for the Gunk emulsion solution.—AVIATION, *December, 1937*

AN Fafnirs

New bearings to aircraft standards.

NOTE THE LATEST FAFNIR DEVELOPMENT a series of bearings developed especially for the aviation field and designated KF, KF-A and DF Series The new bearings are of the double felt-seal type, both the KF and KF-A being single row, while the DF makes use of a double row of balls. The K-A bearing is an Army Air Corps standard and the KF a Navy standard—AVIATION, *December, 1937*

Plug Conditioner

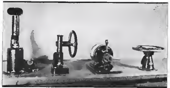
Handy tooling for service shops.

DESIGNED SPECIFICALLY for servicing radio shielded aircraft engine spark plugs, a new set of bench tools developed by the Thos. L. Siebenthaler Co., of Kansas City, Mo., includes a spark plug tester, a point setter, a point cleaner and a special assembling tool—AVIATION, *December, 1937.*

Anemometer

Velocity measurement from 3 to 75 m.p.h.

FAVORITE airport guessing game is "How fast is the wind blowing?" Guessing is eliminated, however, by the type B Anemometer offered by M C Stewart, of Arlington, Mass. A standard four cup instrument of approved design, it is said to be sensitive to wind as low as 3 m p h and is guaranteed to withstand a wind of 75 m p h In operation the instrument, using any standard low voltage electric current such as a dry cell, operates a small buzzer or flashlight to indicate speed by the number of contacts made per second. The price of this instrument is low, bringing it within reach of every airport owner or operator—AVIATION, *December, 1937.*



Siebenthaler Spark Plug Conditioner

Self Locking Screw

New device cuts own thread, stays put.

LATEST LOCK-TITE, SHAKE-PROOF, VIBRATION-RESISTING, LOCK PRODUCT is a screw that cuts it own threads, locks itself in and throws away the key. This unique product, serving a much more serious purpose than this facetious introduction might indicate, is the development of the Shakeproof Lock Washer Company, 2501 North Keeler Ave., Chicago, Ill The screw will cut its own thread in metals and plastics of practically any thickness Its patented thread-cutting slot, plus a special hardening process, eliminates the ordinary tapping operation required of standard machine screws. Should it be necessary to replace the screw an ordinary machine screw of the same size will fit its threads—AVIATION, *December, 1937.*

Window Shopping

Each month a large number of interesting and informative illustrated catalogs come to the Editors of AVIATION We have selected those for listing which seem particularly timely Readers may obtain them by writing directly to the manufacturer

ALUMINUM COMPANY OF AMERICA, Pittsburgh, Penna.
Aluminum Paint Manual—A 106-page book dealing with all types of painting with aluminum pigment

BAKELITE CORPORATION, 247 Park Avenue New York, N Y.
Bakelitems and Bakelite Review—Monthly publication dealing with applications of bakelite to industry

BENDIX RADIO CORPORATION, 9th & Kearney Sts., N.E., Washington, D C.
Radio Communication and Navigation Equipment—An invaluable compilation of all types of Bendix radio equipment now available.

DARDELET THREADLOCK CORPORATION, 55 Liberty St, New York, N Y
Bulletin No. 17—Describes the use of Dardelet self locking thread on cap and set screws

HAYNES STELLITE COMPANY, Kokomo, Indiana
The Haynes Stellite Library—A small 8-page folder listing all available catalogs and literature on Stellite application to hard-facing alloys, cutting tools, etc A total of eighteen different books and pamphlets are listed.

Hard Facing With Haynes Stellite Products—A new and more complete book on this subject Shows all types of hard-facing applications, such as special valves, in a 104-page manual.

THE KORFUND COMPANY, INC., 48-15 Thirty Second Place, Long Island City, N Y
Eliminating Vibration Losses—A 16-page illustrated book dealing with application of special spring bases, sound deadeners etc to the mounting of industrial machinery such as presses, drop-hammers, etc.

LUDLUM STEEL COMPANY, Watervliet, N Y
The Working of Silcrome Stainless Steel—A factual data book giving detailed instructions for fabricating Ludlum stainless steel

NIAGARA MACHINE & TOOL WORKS Buffalo, N Y
Niagara Inclinable Presses—Niagara Horn Presses—Two very complete illustrated catalogs and data books dealing with special production presses for manufacture of stampings, etc

KARL ORT, York, Penna.
Ort Aeronautical Supplies—Ort's latest catalog of aeronautical supplies really should have a full page description at least. We must summarize by saying that anyone in the aviation business cannot afford to be without this book. A masterpiece!

J. H. WILLIAMS & Co., 75 Spring St, New York, N Y
Tools of Industry—A splendid 184-page illustrated catalog of Williams hand tools and special Williams products
AVIATION, *December, 1937*

THE AVIATION NEWS

REVIEW, COMMENT, FORECAST

DECEMBER 1937

DANIEL SAYRE

C. F. McReynolds, *Pacific Coast*
Blaine Stubblefield, *Washington*
E. R. Leckin, *New York*

Loening Sides With Clippers

Boosts Maritime Commission Control; Says Normandies Out, Zeppelins Fair

ON Nov 8, Joseph P Kennedy, Chairman of the U S Maritime Commission, issued a long report on the present status and future prospect for the country's down-and-out merchant marine. Editorial comment almost universally called the report, "informative," "refreshingly realistic," "ultimately constructive."

Mention of aircraft's part in ocean transport had been favorable but limited; some ten days later Chairman Kennedy issued a special report on "Aircraft and the Merchant Marine" with special acknowledgment of the assistance to Grover Loening, Aeronautical Adviser to the Commission. Since it barges straight into one of the most complex situations in the history of the up-and-coming air transportation industry, this second report steps cheerfully upon a score of tender aeronautical toes. We present our necessarily severe cutting of the report's 35 pages. Its general character seems also "informative, refreshingly realistic, probably ultimately constructive."

ENGINEER, AUTHOR, EXPERT
Loening works-up a report

Trans-Ocean Flying is Practical

The recent development and performance of long-range ocean-going aircraft has opened to the shipping business of the world, a new field requiring its most thorough consideration.

Direct competition between aircraft and ships in carrying mails and passengers on the world's trade routes is clearly indicated in the near future . . . The problem of transoceanic aviation is essentially one of range and size of aircraft. The work now going on in this country in design and actual manufacture will result in the immediate future in the construction of 120,000 pound flying boats of 5,000 mile non stop range, carrying 40 to 50 passengers at an average speed of 175 m.p.h. . . . The elimination of intermediate landings in the Atlantic, whether in the ice and fog of Newfoundland or the rain and low ceilings of the Azores, will . . . reduce take off and landing risks . . . Such flying boats will acquire the great advantage possessed for years by the dirigible airship alone—sufficient range to circumnavigate weather obstacles . . .

Big Aircraft are Comfortable

The very much higher wing loadings now being used on long-range ocean-going aircraft have greatly reduced the effect of the airplane of rough air. . . . The noise has been reduced by modern soundproofing methods to less than that of a Pullman car with the windows closed. . . . In the case of dirigibles, it is almost the unanimous opinion of those who traveled on the "Hindenburg" that there is no means of transportation either on sea, land or in the air that is quieter, smoother or more comfortable than the airship . . . With regard to ventilation, the easiest of all transports to air-condition is the airplane . . . The berths in the flying boat designs are much wider and more comfortable than those in a Pullman . . . .

Ocean Flying Cheaper

In order to study relative costs, it is essential to find a basis in a similar trade route service. The obvious one to choose at this time is the transportation of passengers across the Atlantic. In view of the fact that an American superliner costing $50,000,000 would take three years to construct, comparison is made to dirigible and flying boat designs which are now under complete

(*Continued on page 64*)

THE FLIGHT PLAN

The tenth Annual All-American Air Maneuvers start in Miami Dec 2 (Thursday) and run through Sunday the 5th. The meet will be at Miami's new municipal airport. There will be a grandstand for 10,000. Plans call for a New York-Miami race to open the program; a sportsman's Miami-Havana cruise to close it. Big Cub and Aeronca "convoys" have been organized. Groups planning meetings in Miami during the meet include: The National Association of State Aviation Officials, The Ninety-Niners, The Alligator Club, The Florida Aviation Association and the Sportsman Pilots Association.

That Class A Airshow of Chicago's (Jan. 28-Feb. 6) looks good from this point. The industry's first one-hundred-million-dollars-plus year seems to be leaving it with enough loose change not to mind show costs for once. The central location is attractive. The management is pushing hard. Indications are there will be more complete and more numerous exhibits than at any air-show in American history.

The Institute of the Aeronautical Sciences is dividing its Winter program features this year. The Dinner will be held at the Hotel Biltmore in New York City, Dec 17. Following it, Prof. B. Melvill Jones of Cambridge University will deliver the Wright Brothers Lecture, announcements will be made of new honorary fellowships, and the Daniel Guggenheim Medal, the Sylvanus Reed Award and the Lawrence Sperry Awards will be conferred. On Dec. 21, Prof. Jones will repeat the Wright Lecture in Pasadena. The Annual Technical Meeting will be held, as in past years, at Columbia, Jan. 24-26.

BOEING FIELD OVERCAST: The XB-15 flies serenely through its flight tests—at speeds "around 250 m p h" A few details have now been released. Length, 90 ft. Height, 18 ft. Wing spread, 150 ft. Power plant four 1,000 hp P & W twin-row Wasps. Gross weight, "more than 30 tons."

Air Corps Boosts Contracts to 1,200

Has More Planes on Order Than On Hand; Approaches 10-Year Goal

ON OCT 20 LAST, to the best of our determining, the U. S. Army Air Corps had on hand some 900 airplanes that could be classified as of modern design and production About 300 of these were attached to the G.H.Q. Air Force whose total strength ran to about 350. Ten years after the passage of a law authorizing a strength of 1,800 up-to-date ships, this is not too fine a showing

Fortunately on that date the War Department had under construction or had let recent contracts for an almost even thousand new planes, the exact number being confused beneath "spare-parts" allowance and lag of obtainable information on latest deliveries. More strikingly still, the Air Corps since that date have boosted those orders by an exact 20 per cent

Item: Oct. 21, the award of a contract to North American Aviation for 55 additional Model O-47A observation planes and spares at a cost exclusive of $1,731,407. (The O-47A is a three-place, mid-wing monoplane with retractable wheels which is powered with an 850 hp. Wright, and equipped with flaps In February of this year North American won a contract for 109 at a price of $3,429,000)

Item Oct. 23, the award of a contract to Stearman Aircraft for 20 more PT-13A primary trainers at a contract price of $122,220 (These, like their predecessors, will be powered with a 220 hp Lycoming. They are of course 2-place biplanes).

Item Nov. 8, the award of a contract to North American Aviation for 95 more basic combat planes and spares similar to those already under production by the same company Total cost ex engines will be $1,490,921 (These are low-wing, tandem cabin monoplanes powered with P & W 550 hp Wasps They seat two and are designed for observation and courier service)

Item Nov. 9, the award of a supplemental contract to the Douglas Aircraft Company for 20 additional Model A-17-A attack planes at an ex-engine cost of $954,156. They are to be constructed at the company's Northrop factory at Inglewood, Calif (The A-17-A is a low-wing monoplane with provision for pilot and one gunner It is powered with a twin-row P & W Wasp Jr. and can cruise at over 220 m p h for eight hours. It carries four fixed and one flexible machine gun and some 20 fragmentation bombs)

Estimates of future Corps strength are difficult. With present delivery speeds continued, good guess is about 1,800 planes at the end of 1938—2,320 planes, the new legal limit, sometime in 1939 Present Corps ambition is for a crack fleet of 1,600 planes for G H Q by the end of the next twelve months

Signs in Washington indicate a drive in Congress next Winter for a big increase in appropriations for new Corps aircraft and the framing of a new program much larger in its ultimate limits.

SPOT LANDINGS

On the Month's News

The 1938 Air Races should have it over previous Races like the China Clipper over a Sky-Louse First of all the four-day program will be concentrated into three (Saturday, Sunday, Labor Day) which will be a boon to those of us who turn up for the whole meet. The Prize Money is going way up to $102,750 Principal Items: $30,000 for the Bendix, $45,000 for the Thompson, $25,000 for the Greve. All the rules are overhauled—Bendix planes (but not pilots) cannot be entered in the Thompson also The 397 cu in. class races are eliminated, so are qualifying races. Qualifying speed trials are set for the three days prior to the meet opening The starting field for closed course races is increased from ten to fifteen

Donald Douglas reopened the Northrop plant after a 48-day shutdown Practically the full staff of the plants, 1400 workmen, signed individual contracts pledging themselves not to strike and authorizing a deduction of $15 from their pay checks in case of violation of contracts Douglas labor difficulties are not yet completely out of the way however

A German landplane flew 379.16 m p h last month to break Howard Hughes' mark of 352.39 m p h and to carry away another of America's fast-dwindling store of international records The plane was a trim little Messerschmitt monoplane equipped with a Daimler Bentz engine The pilot's name was Wurster

The Post Office has asked for bids on a U S Bermuda air mail service Specifications include seaplanes or amphibians with capacity for ten passengers and 500 lb of mail, a three year contract period, an understanding that this service is separate from any through-service to Europe and may be reduced or suspended if, when and as such a through-service starts. Bids will be opened Jan 15 Service must start within six months of that date.

The accident board said "pilot's error" in an informal press conference following Secretary Roper's approval of findings on United's Mainliner crash in Utah. The formal report found a combination of causes (1) State conditions encountered in the last portion of the flight which drowned out the beam signals; (2) Continuation of the flight into mountainous country at an altitude below the higher peaks without definite identification of position; (3) An unpredicted change of weather taking place along the course

Six Bid On Bombers

Navy To Decide This Month On $20,000,000 Business

SINCE OUR NAVAL AIR SERVICE began to hide its statistical light under a bushel a few years ago, estimates of our sea-going air strength are not easy Best available current data is the statement in Rear Admiral Cook's Annual Report (released last month) that, "On June 30, 1937, the Navy had 927 service and 195 obsolescent aircraft on hand and 820 new aircraft on order . . . of the large number on order the majority are due or overdue for delivery and will be delivered within the next few months."

Oct. 30 The Navy matched the Air Corps procurement fire-works by announcing it had opened bids on 270 bombers of various classifications

On one group of 14 patrol bombers, the Glenn L. Martin Co., bid $2,086,806 The Martin Co was the only bidder

On another group of 78 patrol bombers, Consolidated Aircraft Corp, San Diego, bid a total of $8,052,000 United Aircraft Corp, Sikorsky aircraft division, Stratford, Conn, bid $9,041,254

On a group of 58 scout bombers, Brewster Aeronautical Corp. bid $3,680,400 and United Aircraft Corp, $3,425,694

On another group of 31 scout bombers, the Brewster Co bid $2,267,160 and United's figure was $1,897,670

Curtiss-Wright Corp, Buffalo, was the only bidder on two other types of scout bombers, submitting a figure of $1,690,174 for one group and $2 929,278 for the other

Navy officials emphasized bids were on a "restricted" basis and the specifications and the probable performance of the ships bid for would not be made public None of the bids have been accepted, many perhaps would not be accepted, and no definite action would be announced for about two months

TO RULE ABOVE THE WAVES?
Kennedy asks control for MM

AVIATION IN WASHINGTON

by BLAINE STUBBLEFIELD

» The Maritime Commission won't get control over offshore air transport just for the asking, of course For one it will have to battle the Post Office. The Commission will contend that aircraft will have an increasingly important place in overseas trade, that shipping and aircraft will develop closer relationship. The Post Office will answer that the Commission was organized to administer a ship subsidy law, that it is overstepping its ground in moving to assume responsibility for trans-ocean air transport.

» A determined stand by the Commission for its objective would be formidable indeed Grover Loening, who made the aviation study and report for the Commission, is "Grover-and-Joe" with Chairman Joseph P. Kennedy The youngish, hard hitting Mr Kennedy is just the type that would go for something like aviation His friends now say he is likely not to resign at the year-end, as expected; that would please the National Maritime Union too much So he may stay and lend aid toward getting Congress to enact his amendments to the maritime law, including oversea air control

» Again, the Interstate Commerce Commission would control, by certificate to operators, both domestic and foreign airlines if McCarran's S2 bill is enacted But the group favoring the ICC could probably relinquish the foreign control to the Maritime Commission in order to get its law on the books and be clear of the Post Office Furthermore, those "foreign operators" who might oppose maritime control are only one company so far The others are merely potentials, and a lot of them are maritime minded And certainly the super liner section of shipping will take an interest in the Commission's plans. Such companies as United States Lines, and the Dollar line know that aircraft will cut into their business, and they will want to do the cutting themselves. Several foreign companies are well along with air auxiliary plans So is American Export Grace is already heavily interested in Pan American-Grace Airways

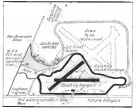
» Dirigible protagonists think the report tends to pass lighter-than-air off with faint praise But they are not discouraged If an off-shore air subsidy law is enacted they will promptly propose service with large-capacity equipment already developed, while airplane people will have to talk about equipment of similar capacity expected in the near future Incidentally, the balloonists will not be the last to remind the government that 20-hour flights might well carry full multiple crews. Which would be quite a load of crew for present airplanes

» Something must be done about airline legislation in this special or in the next regular session of congress. So say Washington representatives of the domestic industry They say the President's aviation legislation committee can add nothing to studies and reports already made Whatever stand the committee may take will not alter the airlines' determination to get ICC or other independent control It seems possible as this is written that the committee may compromise and suggest that Commerce keep safety regulation and that ICC route certificates replace the Post Office contract system

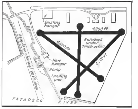
» Airport "shortage" is out of hangar talk into operators' balance sheets The Post Office ruling for six months notice before big airplanes can hightail little airports was inevitable And the operators knew it, their contracts call for mail performance They were just taking time out to flirt with that nice long-haul temptation The Post Office wants the six months for everybody to sit around the ironing-out board And critics say it's a good idea, before some customer cities get mad and burble the air

» Plain and fancy diplomacy by state officials, municipalities, mayors, airplane builders, operators, Post Office, and Works Progress at the Bureau of Air Commerce airport meeting December 6-7 will bring a decision The decision ask the government for more money to build and enlarge airports The argument: safety, a parallel to constitutional provision for post roads, and national defense Private pilots' airport troubles will be handled later

» The airway aids project being boomed for Alaska (and Hawaii) would write another chapter of air pioneering Tentatively the Bureau of Air Commerce plans to ask for about $8,000,000 The Alaskan system would take two or three years to complete Hawaii would take a year or so.



FRISCO'S FIELD: A before-and-after plan of the municipal airport upon which San Francisco will spend $2,850,000. Already used by United and TWA, provision of seaplane facilities will bring Pan American's trans-Pacific terminal from Alameda across the Bay. Items: $324,000 for fills and seawalls, $335,000 for dredging, $862,000 for seaport buildings, $1,375,000 for hangars.



BALTIMORE'S BASE: Over 80 per cent of the necessary fill has already been placed, landplanes should be able to use runways by late next summer. Pan American and Imperial Airways moved their mainland maintenance operations for their Bermuda service into the old Capreni hangar last month. A permanent hangar will be ready for them in January according to present estimates.

Frisen Pushes 3 Big Ports

VOTERS of the city of San Francisco provided for major improvement of San Francisco Municipal Airport through approving a $2,850,000 bond issue at the polls on Nov 2. Money to be provided by this bond issue will be spent for enlargement of the present runway system, provision of additional landing and mooring facilities, and construction of a seaplane harbor. The provision of an adequate seaplane harbor is believed to assure the permanent acceptance of San Francisco Airport as a base for Pacific operations by Pan American Airways, now operating from a temporary base at Alameda. Other San Francisco Bay airport projects under way include rapid progress on the Exposition Island airport work, site of the projected international exposition for 1939 and strategically located in the center of San Francisco Bay. At Oakland Municipal Airport a WPA project has provided for installation of a new paved taxi strip, five Cooper Hewitt lights, painting of hangars 1, 2, and 5, and additional macadam roadway construction within the airport area.

Buffalo Breaks Ground

WORK on Buffalo's $1,200,000 airport modernization project got under way last month with 210 WPA workers engaged in digging sewers and ditches. About 225,000 cubic yards will be excavated. Work on the project had been held up for several months by technicalities between government and municipal authorities. More then 1100 men will be working on the project within the next few weeks. A new administration building will be built. Seven new hangars, a clubhouse, a garage, a recreation building will also be added.

Alabama Plans Port Program

LAST MONTH a group of federal officials headed by Corrington Gill and Col Sumpter Smith of the WPA and Maj. A. B. McMullen of the Bureau of Air Commerce made a nation-wide tour of the country's airports gathering first-hand data for an extension of current airport relief-work projects. When it visited Alabama, state aviation officials presented a "Potential, Long Range Airfield Development Program for Alabama"—a thoroughly worked-out plan for the eventual construction or further improvement of 118 fields in 118 Alabama communities. Estimated over-all cost, more than $5,000,000.

Palwaukee to Sky Harbor

THE FLEET OF TRAINING PLANES previously operated by Palwaukee Airport, Inc now flies under the colors of the newly organized Turgeon Flying Service, Sky Harbor Airport, Chicago. The move from the old Palwaukee Airport to the new location at Sky Harbor was made Nov. 1st.

L. A. Buys Municipal A'port

WHILE RIVAL SUBURBAN COMMUNITIES of Los Angeles County held mass indignation meetings, or mass victory dinners, depending upon which side of the city of Los Angeles they happen to be located, title to the Los Angeles Municipal Airport officially passed to the city of Los Angeles during the first week in November with payment of $250,000 under the airport purchase plan providing for payment of a total of $2,692,152 over a period of ten years. Towns located in the San Fernando valley north of Los Angeles, and those located in the vicinity of Union Air Terminal, Burbank, were seething with indignation over the purported plan to transfer all airline activities in this area to Los Angeles Municipal Airport. South of Los Angeles the City of Inglewood, which adjoins Los Angeles Airport, staged a victory dinner in honor of the airport purchase.

SCHOOL HIGHLIGHTS

» THE BOEING SCHOOL OF AERONAUTICS is now using a Boeing 247 D for flight training in multi-motored aircraft. Instruction of this type is included in the Airline Pilot and Operations, and Special Airline Pilot Courses.

» NEW YORK UNIVERSITY has announced the creation of the Richard F. Hoyt Memorial Seaplane Fellowship at its Guggenheim School of Aeronautics. Funds for the Fellowship, totalling $3,000 were subscribed by friends of the late Mr. Hoyt an ardent seaplane enthusiast. The Fellowship will carry an annual grant of $500 and remission of tuition to a graduate in aeronautics from an American college. He will, of course, devote his research efforts to the seaplane field.

» PARKS AIR COLLEGE warns it will be able to admit only a very limited number at the beginning of the Winter Term, Jan 4. The present enrollment is already at 302, approximately the College's capacity. Only fourteen vacancies will be opened through graduation.

All Chicago Backing Show

Exhibitors Rush for Space
National Groups Plan Meetings

REPORTS from the hard-working committees in charge of arrangements for the International Air Show—scheduled for Chicago Jan. 28-Feb. 6—indicate that the American Aeronautical Industry is about to have the biggest show in its thirty years of history.

By late November more than 150 airplane, engine or accessory manufacturers had signed up for space. Between 75 and 100 airplanes had been listed as certain exhibits. Practically every important group within the industry had completed arrangements to hold important national or regional meetings in connection with this International show.

The great fireproof building which will house the Show was constructed in 1935, contains 255,000 sq. ft. of exhibition space on the first two floors. The first floor, which has been entirely reserved for airplane exhibits, contains the huge 6,000 seat amphitheatre shown in the accompanying photo. Flanking it are two large exhibition halls totalling 114,000 sq. ft. The second floor will be devoted three-fourths to exhibits of accessories, engines and parts, one-fourth to educational exhibits portraying the activities of the N.A.C.A., the Air Corps, the Navy, the Bureau of Air Commerce and other governmental agencies. Generous space will also be set aside for junior pilot organizations devoted to model building.

External arrangements are no less full-scale. There will be a protected free parking area for 20,000 cars, which in advance of the Show will form a 1760 x 200 ft. landing strip for exhibitors' planes. Directly connected with the Amphitheatre is the Stockyards Inn, a new $800,000 hotel, where 175 rooms will be available at reasonable rates for exhibitors and visitors. Executives of firms exhibiting at the Show will receive cards to the nearby Saddle and Sirloin Club, the luxurious private clubhouse of the leaders of Chicago's meat industry.

A score of leading Chicago organizations are either actively working on definite phases of the Show program or have heartily endorsed the entire enterprise. Mayor Edward J. Kelly and the City Council, the Chicago Association of Commerce and the Junior Chamber of Commerce have lent full cooperation. The Chicago Aero Commission under the leadership of Merrill Meigs and Reed Landis has been actively driving to line up meetings of groups within the industry. The Aviators Post of the American Legion is planning a Legion Day at the Show and an attendant conference of state representatives. Others planning special get-togethers include the National Aeronautical Association, the SAE, the Aeronautical Division of the American Society of Mechanical Engineers, the National Association of State Aviation officials; the Early Birds and the Quiet Birdmen.

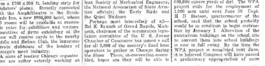
Perhaps most interesting of all—Rel K. Branch of Grand Rapids, Michigan, chairman of the aeronautics legislation committee of the U. S. Junior Chamber of Commerce has issued a call for all 3,000 of the country's fixed base operators to gather in Chicago during the Show. There, in-convention assembled, hopes are they will be able to thresh out many of their most serious common problems.

We're going. What are you going to be doing about Show time?

BIG ENOUGH FOR POLO: A rather empty view of the huge arena of Chicago's International Amphitheatre. For ten days beginning Jan. 28 this place will be crowded with a score or so of the planes to be exhibited at the International Air Show—including a Douglas DST sleeper and four amphibians floating in miniature lakes. Most plane exhibits will be in other halls.

Denver Starts Tech. School

GRADING OF RUNWAYS for the landing field at the Denver, Colo., Army Air Corps technical school has finally been started, following the signing by President Roosevelt of a $968,000 WPA project for initial work at the field, and approval by the war department of a year's lease on the school site. Army engineers estimate the preparation of runways will involve the moving of 600,000 square yards of dirt. The WPA project calls for the employment of 1,000 men until next June 30. Capt. H. D. Stetson, quartermaster of the school, said that the school probably would be in condition to begin instruction by January 1. Alteration of the sanitarium buildings on the school site to convert them into school buildings is now in full swing. By the time the WPA project is completed next June, it is believed Congress will have passed a preliminary appropriation of more



COUNT THE CUBS: Here are the men who will sell you one as they have sold them to almost 2,000 other customers during the past three years. Some of the 50 distributors and sales officials who last month turned up in Lock Haven, Pa. for a Cub sales meeting. Leaders in the discussion at the conference included President W. T. Piper, Sales Manager Ted Weld, and W. B. St. John, William D. Strohmeier, Paul A. Weld, Findley Estlick, and Max Beeke, also M. S. Hutchins of the Hutchins Advertising Agency, Gordon Curtiss, W. A. Schlegel, and Fred Bremier.

FOR THE GHQ: The new shoulder patch to be worn by members of the Air Corps' striking force. The three-bladed "impeller" design is of ultramarine blue, the circular background of orange.

than $2,000,000 to start the erection of new buildings. The Denver city council recently passed on final reading an ordinance for the issuance of $750,000 worth of bonds by the city to buy the site for the school and 100 square miles of bombing range near the city.

Danes Take to Cubs

TAYLOR AIRCRAFT COMPANY has announced the receipt of an order for 27 Cubs from Denmark on Nov. 4. This order, the largest single foreign shipment of Cubs ever prepared by the Piper Corp., was placed by Cub Aircraft Ltd., Copenhagen, Denmark. 25 Cubs are to be shipped immediately in knock down form with fifteen dual ignition Continental engines and ten single ignitions. An order for two completely assembled ships also accompanied the order which followed closely after the shipment of two Cubs to Copenhagen Oct. 27. Cub Aircraft Ltd. will eventually do the complete manufacturing in Denmark upon receipt of jigs and dies from the American factory. The plant will serve as an outlet for Cubs to all European countries.

Douglas Omits Dividend

Needs Profits for Operations

FACED WITH THE NECESSITY OF CONSERVING WORKING CAPITAL, the Douglas Aircraft Company, Inc., in releasing its nine months' operating statement for the period ending August 31, last, recommended that no dividends be paid during the fiscal year ending November 30, 1937. Net profits for the nine months covered by the report were $1,057,785.09. Consolidated backlog of unfilled orders as of October 29, stood at $31,535,235.44, consisting of 85 per cent Army, 13 per cent Navy, 2 per cent domestic transport and 3 per cent foreign transport and military orders. This backlog compares with $34,800,000 on last August 28, and the all-time high of $38,031,800 on last June 11.

TRICYCLE SALESMAN: Roscoe Turner, speed merchant, adds a new line of goods. Stearman-Hammond have appointed him Mid West distributor.

COMMERCIAL DELIVERIES

AVIATION'S summary of airplane marketing for the month ended Nov. 1, 1937

Purchaser	Location	Type of Buyer	Manufacturer and Model	Engine Make and Model
Waco Sales of N Y	N Y	Pvt	Waco YKS-7	Jac. L-4
Western F B	Mich	Pvt	Waco YKS-7	Jac. L-4
E. Stevens	N Y	Pvt	Fairchild 24 G Del	Warner S.S.
Henry S. Morgan	N Y	Pvt	Fairchild 24 G Del	Warner S.S.
D. B. Gauss	Mich	Pvt	Taylor-Young Model A	Cont. A-40-4
Fox Valley F S	Ill	F B	Taylor-Young Model A	Cont. A-40-4
Charles Perez	Ill	F B	Taylor-Young Model A	Cont. A-40-4
Torpess F S	Ill	F B	Taylor-Young Model A	Cont. A-40-4
R. E. Whipp	Md	Pvt	Taylor-Young Model A	Cont. A-40-4
J. B. Rennie	Va	Pvt	Taylor J2	Cont. A-40-4
Coast City F S	N C	F B	Taylor J2	Cont. A-40-4
Airways, Inc (2)	Maine	F B	Taylor J2	Cont. A-40-4
Robert Gano	Mass	F B	Taylor-Young Model A	Cont. A-40-4
Aero-Ways (2)	Ohio	F B	Taylor-Young Model A	Cont. A-40-4
Weeede Flyr	Norway	F B	Taylor J2	Cont. A-40-5
A. H. Deleeuwin	Wyo	F B	Taylor J2	Cont. A-40-4
Queen City F S	Ohio	Pvt	Waco EGC	Jac. L-6
Tala Sales, Ltd	India	Trans	Waco YGC	Jac. L-4
Brady & Brown	Mich	Pvt	Taylor J2	Cont. A-40-4
W. H. Randolph	N J	Pvt	Taylor J2	Cont. A-40-5
L. C. Arnis	Ind	F B	Taylor J2	Cont. A-40-4
Valenthe A. S	Ill	F B	Taylor J2	Cont. A-40-4
Jones & Sutherlin (6)	Calif	F B	Taylor-Young A	Cont. A-40-4
M. C. Palmer	N Y	Pvt	Taylor-Young A	Cont. A-40-4
P. L. Whitman	N Y	Pvt	Taylor-Young A	Cont. A-40-4
Cub F S	Colo	Pvt	Taylor J2	Cont. A-40-4
Thompson F S	Utah	F B	Taylor J2	Cont. A-40-4
Aircraft Assoc. (2)	Calif	F B	Taylor J2	Cont. A-40-4
Southern A. S	Tenn	F B	Taylor J2	Cont. A-40-4
Air Activities	Texas	Pvt	Fairchild 24 G Std	Warner S.S.
Roy Snyder	Penn	Pvt	Fairchild 24 G Del	Warner S.S.
Everett & Dwyer	N Y	Pvt	Fairchild 24 K	Ranger 6-390D-3
Cub Aircraft Ltd. (2)	Denmark	F B	Taylor J2	Cont. A-40-4
Gustav Wahlman	Sweden	Pvt	Taylor J2	Cont. A-40-4
Pabl Ziel	Uruguay	F B	Taylor J2	Cont. A-40-4
L. D. Brown	Mich	Pvt	Stinson SR-8B	Lyc. R680-B6
Cuba Story	Cuba	Govt	Stinson SR-9DD	Wr. R-760-E1
Braniser & Cowden	Texas	F B	Taylor-Young A	Cont. A-40-4
R. & O. Ross	Ohio	Pvt	Taylor-Young A	Cont. A-40-4
R. Richardson	S C	Pvt	Taylor-Young A	Cont. A-40-4
Ivan Munson	Fla	F B	Taylor-Young A	Cont. A-40-4
Bradley & Young	Ga	F B	Taylor J2	Cont. A-40-4
Parkersburg F S	W. Va	F B	Taylor J2	Cont. A-40-4
Philip Moore (2)	Ohio	F B	Taylor J2	Cont. A-40-4
Loy Foote	Texas	F B	Taylor J2	Cont. A-40-4
H. F. Hamilton	Penn	Pvt	Fairchild 24 G Del	Warner S.S.
Pierre Bailly	N. Y.	Pvt	Stinson SR-9C (BD)	Wasp, Jr. 400 h.p.
Baskins & Erickson	Okla.	F. B.	Taylor J2	Cont. A-40-4
Art Whitaker (3)	Ore.	F. B.	Taylor J2	Cont. A-40-4
W. K. Carpenter	Ill.	F. B.	Taylor J2	Cont. A-40-4
G. McConnell	Kan.	F. B.	Taylor J2	Cont. A-40-4
B. D. Carpenter	Kan.	F. B.	Taylor J2	Cont. A-40-4
T. L. Sznak	Minn.	Pvt.	Taylor J2	Cont. A-40-4
Harold L. Alford	Ill.	Pvt.	Taylor J2	Cont. A-40-4
Tufts-Edgcombe	Ill.	F. B.	Taylor J2	Cont. A-40-4
G. R. Barham	Texas	Pvt.	Stinson SR-9FD	Wasp, Jr. 440 h.p.
D. G. Graham	Wash.	Pvt.	Stinson SR-9FD	P. & W.
Tufts-Edgcombe, Inc.	Ill.	F. B.	Taylor J2	Cont. A-40-4
John Weiland	Ind.	Pvt.	Taylor J2	Cont. A-40-4
Southwest Av.	Okla.	F. B.	Taylor-Young A	Cont. A-40-4
W. D. Gayetty	Penn.	F. B.	Taylor J2	Cont. A-40-4
G. & A. Aero Club	Ind.	Pvt.	Taylor J2	Cont. A-40-4
G. H. Edenis	Texas	Pvt.	Stinson SR-9C	Lyc. R-680-D5
H. C. Lippiatt	Calif.	Pvt.	Waco YKS-7	Jac. L-4
Jorge Luro	Argentina	Pvt.	Waco YKS-7	Jac. L-4
W. Hagwell	La.	Pvt.	Taylor J2	Cont. A-40-4
Mary Sauge	Ohio	Pvt.	Taylor J2	Cont. A-40-4
DuPont A. S.	Minn.	F. B.	Taylor J2	Cont. A-40-4
G. R. Rosser	Texas	Pvt.	Taylor J2	Cont. A-40-4
Norman Smith	Penn.	Pvt.	Taylor J2	Cont. A-40-4
Bismarck F. S. (2)	N. D.	F. B.	Taylor-Young A	Cont. A-40-4
Little Corp.	Penn.	F. B.	Taylor-Young A	Cont. A-40-4
R. D. Clemson	N. Y.	Pvt.	Fairchild 24 G Del	Warner S.S.
Don Wood	Calif.	Pvt.	Fairchild 24 G Del	Warner S.S.
Brayton F. S.	Mo.	F. B.	Taylor J2	Cont. A-40-4
A. M. Preston	Mo.	Pvt.	Taylor J2	Cont. A-40-4
Wiggins A'ways (3)	R. I.	F. B.	Taylor J2	Cont. A-40-4
Cannon & Mills	Fla.	F. B.	Taylor-Young A	Cont. A-40-4
Stephens, McMurray & Cater	Ga.	Pvt.	Taylor Young A	Cont. A-40-4
Livingston A'ways	Iowa	F. B.	Taylor-Young A	Cont. A-40-4
LeBlanc Bros.	Okla.	Corp.	Beech E17B	Jac. L-5
Prest-O-Lite	Ohio	Corp.	Beech D17R	P. & W.
Dept. of Aero.	Conn.	Govt.	Beech E17B	Jac. L-5
A. Goddard	Calif.	Pvt.	Monocoupe 90A	Lambert 90R266
M. Harvey	Calif.	Pvt.	Monocoupe 90A	Lambert 90R266
North Beach A. S.	N. Y.	Corp.	Howard DGA-11	Jac. L-5
Clevenger (2)	Texas	Pvt.	Howard DGA-8	Wr. R760E2
Howard A. C.	Ill.	Demons.	Howard DGA-8	Wr. R760E2
C. Hartley	Minn.	F. B.	Beech E17B	Jac. L-5
Mannis A. C.	Ind.	F. B.	Beech E17B	Jac. L-5
Skobe A'lines	Mass.	F. B.	Beech 18B	2 Jac. L-5

Consolidated sales for the nine months ended August 31 were $15,283,066.48, and sales for the year to November 30 will be in excess of $20,000,000 according to company officials. There are now approximately 7,400 employees on the Douglas pay roll. A recent wage increase was granted to 9,750 employees, calling for an additional $35,000 per month.

Coast Holds To Show

Plans Third Exposition April 2nd

CALIFORNIA'S 3RD ANNUAL PACIFIC AIRCRAFT AND BOAT SHOW will be staged in the Pan-Pacific Auditorium, Los Angeles, from April 2 to 10 inclusive, according to announcement by Clifford W. Henderson, manager, following a conference with the board of directors of the California Air Industries Association, show sponsor. As in previous shows, the aircraft exhibits will occupy the center of the exposition building, with accessory, instrument, and engine exhibits grouped around the walls of the building.

Exports Stay Up

9 months figures break all marks

FOREIGN SALES of American aeronautic equipment in the first nine months of the year were valued at $27,426,352, compared with $15,982,287 for the same period of 1936, an increase of 72.7 per cent, according to the report last month by the Department of Commerce, which set aeronautical exports for September at $3,187,109, compared with $1,934,495 for September, 1936.

The 41 land planes bought by foreign interests in September were valued at $1,625,408, and the planes were bought: By Turkey, 6; The Netherlands, 4; Argentina, 4; Brazil, 4; Mexico, 4; Australia, 3; Venezuela, 3, British India, 3; the Union of South Africa, 3. There were other smaller deliveries.

More Planes; More Pilots

THERE WERE 17,379 PILOTS AND 8,430 AIRCRAFT holding active Department of Commerce licenses on October 1, 1937. On October 1, 1936, there were 15,793 licensed pilots and 7,747 licensed aircraft.

Among the 17,378 persons holding pilots' licenses as of October 1, 1937, were 7,493 transport, 959 limited commercial, 8,234 private and 693 amateur. The licensed pilots included 486 women classified as follows: Transport, 73; limited commercial, 24; private, 329; and amateur, 60.

HEAD MAN: Paul Wilcox who has succeeded John Fornasero as chief instructor in the Ryan School of Aeronautics. Fornasero has joined the Bureau of Air Commerce as an Inspector.

DORN FORMS NEW FIRM

RICHARD V. DORN, who has behind him a long experience as an aeronautical engineer with several outstanding manufacturers and with TWA, has announced the organization of a new factory to be called the R/D Engineering Co. Occupying quarters at the Kansas City, Mo., municipal airport, R/D will concentrate its first efforts on the manufacture of sheet metal assemblies, aircraft heating and ventilating systems and will offer engineering consulting services on all types of sheet metal design and production problems.

PROFITS AND LOSSES

» UNITED AIR LINES for nine months to Sept. 30. Net loss $50,921. Net income for the third quarter however was $411,644. Total passenger traffic during the third quarter topped all United records for any quarterly period. Express was also up 28 per cent above previous marks.

» RYAN AERONAUTICAL COMPANY for nine months to Sept. 30. Net income, $35,817 equal to 14 cents per share. Net income for September quarter $12,264.

» CURTISS-WRIGHT CORPORATION and subsidiaries for nine months to Sept. 30. Net profit, $1,591,584 equal to $1.37 per share on Class A stock. Net profit for the September quarter totaled $690,987. Corresponding 1936 figures were $1,262,132 and $440,321.

» BOEING AIRPLANE COMPANY for nine months to Sept. 30. Net profit, $375,443 equal to 54 cents a share. Net profit for the September quarter totaled $212,546. Corresponding 1936 figures were $131,712 and $39,389.

» FAIRCHILD AVIATION CORPORATION for nine months to Sept. 30. Net profit of $124,827 equal to 37 cents a share. Net profit for the corresponding period of 1936 was $25,118. Unfilled orders Sept. 30 stood at $1,251,256 compared with $1,050,535 on Jan. 1, 1937 and $480,249 Jan. 1, 1936.

» UNITED AIRCRAFT CORPORATION for nine months to Sept. 30: Net profit, $2,720,398 equal to $1.07 a share. Net profit for the September quarter totaled $1,032,343.

» NORTH AMERICAN AVIATION for nine months to Sept. 30. Net profit, $225,788 compared with a net profit of $137,857 for the first nine months of 1936.

» BENDIX AVIATION CORPORATION for nine months to Sept. 30: Net profit, $1,811,169 equal to 91 cents a share. Net profit for September quarter totaled $279,207. Corresponding figures for 1936, $2,130,870 and $287,310.

BOMBER BY BREWSTER: One of the new scout bombers under development by the Brewster Aeronautical Corporation of Long Island City, N. Y. for the U. S. Navy. Last month Brewster bids on two classes of scout bombers were opened in Washington. This is Brewster's most important move to date for a share in major contracts.

MISTER ASSISTANT DIRECTOR
Mulligan moves up in the Bureau

BEGINS A NEW CAREER
Col. Tuttle heads U.A.L. Medics

AVIATION PEOPLE

Who's Who in This Month's News

PROMOTED: DENIS MULLIGAN, Chief of the Regulation and Enforcement Division, to the post of Assistant Director of the Bureau of Air Commerce Present set-up of the Bureau leaves the seven divisions which DIRECTOR FAGG organized early this year as they were, with ASSISTANT DIRECTOR HOWARD ROUGH supervising the Bureau's field program, and Mulligan busying himself with the Washington office and the legal aspects of Bureau activities. For the latter his LLB and his three years association with the law firm of Mengel & Conroy give him the necessary training His aeronautical background derives from service as a pilot and observer in the Air Corps, and his present commission as captain in the Air Corps Reserve. While studying law, commercial aviation was his avocation, and in 1934 he was appointed Chief of the Enforcement Section of the Bureau of Air Commerce, later being detailed to the Solicitor's Office of the Department of Commerce where he was assigned to the legal affairs of the Bureau. He came back to the Bureau in April of this year as Chief of the Regulations and Enforcement Division

RETIRED: COLONEL ARNOLD D TUTTLE, from the Air Corps, after 25 years of Army service For the past four years Colonel Tuttle has been Commandant of the School of Aviation Medicine at Randolph Field, and has supervised the training of flight surgeons for the Army and the Navy. He goes now with United Air Lines as medical director and chief flight surgeon His duties will embrace supervision over the physical fitness of United's flying personnel, and research into the physiological aspects of air line flying. Holder of many decorations, he is also the author of medical books.

APPOINTED. J. J. O'DONOVAN, as general traffic manager of Pennsylvania-Central Airlines, succeeding W. J. AUSTIN In 1927 O'Donovan joined Clifford Ball Company, first airline service established over the Alleghenies which was later absorbed into Pennsylvania-Central Airlines From 1930 to 1936 he served as Division Traffic Manager for the line at Washington, and in May of this year was transferred to Pittsburgh as assistant to PRESIDENT C. BEDELL MONRO His headquarters remain at Pittsburgh

LURED: ROBERT D BUCK, HAROLD NEUMANN, ROGER DON RAE,—from their racing cockpits to the control rooms of TWA transports, all to serve initially as First Officers Rae took five second places at this year's National Air Races, and in 1939 won the N A A. "Champion Racing Pilot" In 1934 and 1935 he was the winner of the Freddie Lund Trophy for precision acrobatics at Miami Neumann, collaborator in the design of his own racing planes, has held the Greve and Henderson Trophies, was Thompson Trophy winner at Cleveland in 1935, and in the same year was N.A.A.'s "Champion Racing Pilot" Buck has established two junior records, to Havana and back in 1931; from New York to Mexico City to Los Angeles in 1932. In 1933 and 1934 he did archeological research from the air for the University of Pennsylvania

THREE MUSKETEERS FORSWEAR THEIR RECKLESS WAYS
TWA's newest First Officers Roger Don Rae, Harold Neumann, Robert Buck

PROMOTION FOR SHORTY
President Patterson congratulates new vice-president Schroeder

ELECTED. Major R W. "Shorty" Schroeder, as vice-president of United Air Lines For the past six months Schroeder has held an untitled executive post with United (AVIATION, June, 1937), where his major interest has been safety in operations He has been active in aeronautics for more than 25 years, and before joining United was Assistant Director of the Bureau of Air Commerce.

STILL IN THE SADDLE
A.T.A. reelects Col. Gorrell

REELECTED COLONEL EDGAR S. GORRELL, CROIL HUNTER, FOWLER W BARKER, as president, vice president, and secretary-treasurer of the Air Transport Association of America. Elections took place at the annual meeting held at Hot Springs, Va on Nov. 1 and 2. The new Board of Directors is composed of T E BRANIFF, JACK FRYE, W. A. PATTERSON, E V RICKENBACKER, C. R SMITH, C. BEDELL MONRO, and CARLETON PUTNAM The two last replace CROIL HUNTER and PAUL COLLINS

EMERGED COLONEL CHARLES A LINDBERGH, from his temporary retirement from aviation affairs Colonel Lindbergh accepted a five-year renewal of his commission in the Army Air Corps Reserve, and also attended a meeting of the Lilienthal Society in Munich in October Mrs Lindbergh accompanied the Colonel on his flight from England to Munich

DIED. LAURENCE RUSSELL WILDER, aged 49, on November 6 Wilder, a ship builder, was active in aircraft production during the World War, and in 1925 built the first Scintilla magneto, becoming president of Scintilla Magneto Company. In 1931 he sought to purchase from the government the carriers Lexington and Saratoga for conversion into passenger liners as well as airplane carriers

. . . COUNT FERDINAND VON ZEPPELIN, nephew of the airship inventor, and his associate in the development of lighter-than-air craft. He died in Berlin on Oct. 28, at the age of 62

AVIATION BOOKS

In Tabloid Review

AIRCRAFT MATERIALS AND PROCESSES, *by George F. Titterton*; Pitman Publishing Corp., New York 1937, 328 pages, $3 50

Titterton, an aeronautical engineer of extensive background who is now on the staff of the Grumman Aircraft Engineering Corp, has put together here a thorough and practical treatise on all modern aeronautical materials and the effect of various manufacturing processes on their properties. Recommended for inspectors, designers, purchasing agents and students

AIR STRATEGY, *by Lieut.-General N N. Golovine*, Gale & Polden, Ltd., London 1936, 114 pages, 7s 6d.

AIR POWER AND ARMIES, by Wing *Commander J. C Slessor*; Oxford University Press, London 1936, 215 pages, $4

Absolute "must" books for anyone seeking a realistic conception of aerial warfare as it will be fought if, when, and as two first class air powers next come to grips. Both books deal primarily with England's acute strategical problems but both are also of wide applicability in their general arguments The first, written by an officer formerly of the Russian Army, deals with numerous aspects of general air warfare doctrine including the now-classic advocacy of "flying-fortresses" by General Douhet; then proceeds into more specific tactical problems raised by modern trends in military and naval designs Wing Commander Slessor, author of the second volume, has been a lecturer on his subject for some years at the R A F Staff College at Camberly His thesis is that the greatest potential role of aircraft is in conjunctive operations with ground troops

SYNOPTIC AND AERONAUTICAL METEOROLOGY, *by Horace Robert Byers*, Sc. D, McGraw-Hill Book Co, New York, 1937, 271 pages, $3 50.

For five years all air line operating personnel and the vast majority of practicing meteorologists have been asking for "one good book on air mass analysis and its aeronautical applications" This is it Dr Byers, product of Dr Rossby's graduate school at M I T and at present in charge of the U S. Weather Bureau's Air Mass Analysis Section, was admirably suited for a task which he has discharged with well-sustained success. The book is not for members of the Junior Birdmen But for those who have a good background in physics and a grasp on elementary meteorology it is full of pay dirt.

LOENING BOOSTS CLIPPERS

(Continued from page 33)

technical solution and are ready to construct when an order is placed. In addition ... consideration is given for the future to dirigibles of 10,000,000 cu ft. carrying 200 passengers, and 250,000 pound flying boats carrying 150 passengers. Both of these are considered by aeronautical experts to be entirely feasible. The times of cost on which this study is based are: (1) Depreciation, (2) Fuel consumption; (3) Wages and subsidence of operating personnel.

Full capacity is assumed ... No consideration is given to terminal expenses on the theory that terminals may be provided aircraft by public ownership ... The superliner uses 8,800 horsepower hours per passenger crossing and the flying boat uses only about one-fifth as much—1,680 horsepower hours per passenger crossing. The dirigible uses 1,692. The large installed power ... and the small number of passengers carried is more than counterbalanced by the brevity of a flying boat crossing ... When it comes to still further increases in speed ... the flying boat has by no means attained its limit. The superliner, even with its power doubled, could increase its speed only a few knots. ... There is considered here only the minimum which is immediately practicable: (1) One superliner making one crossing per week; (2) Two dirigibles making 1½ day crossings on seasonal schedules of 2 to 4 per week; and (3) 6 flying boats making daily crossings both ways. ...

The American construction cost of the superliner is estimated to be $50,000,000. The construction cost of an equivalent passenger capacity in dirigibles would be about the same. The cost of equivalent passenger capacity in flying boats it is estimated will be $18,000,000. The superliner is depreciated on a 20-year basis, the dirigible on an 8-year basis, and the flying boat on a 5-year basis for present designs and an 8-year basis for future designs.

Crew man hours per passenger are very much less on the flying boat than on the superliner or the dirigible, chiefly because of the fact that on a one-night passage, less service is required for the passengers' comfort than would be the case for a longer period. (See chart for overall results.)

The volume of transatlantic first class mail is approximately 7,000 to 8,000 pounds per business day, and the average number of first-class express passengers paying somewhere near the proposed airplane fare (estimated at $450 a passage) is twenty thousand a year. The suggested service of a daily airplane ... with a 40-passenger capacity can, on a basis of a 60 per cent load factor, still have a capacity of well over 6,000 pounds of mail ... could carry very nearly all of the daily first class mail. The five cent ordinary rate to Europe ... would amount to $2 a pound ... (therefore) 6,000 pounds of mail would bring an added income of $12,000 per day to the airlines if they were paid an amount equal to the full postage.

It would appear therefore that these services (one-day to Europe by airplane and 2½ days by dirigible) may, in the near future, be operated at a cost, and with a fare equal to, or possibly less than that of a superliner. Such fast service, with ample capacity for a large part of the passenger, mail and express traffic will cause superliner service to lose much of its appeal and justification for a large class of traffic.

If the shipping companies are not to add aircraft to their fleets, they will undoubtedly lose considerable traffic to independent airline companies.

Dirigibles Still of Use

The dirigible airship still has a place in the merchant marine field. As can be seen from the cost comparison already set forth, it may become superior to the superliner, but ... the more recent development of large long-range flying boats has made the past superiority of the dirigible for transoceanic service much less important. The dirigible is much more expensive in first cost, and its requirements of large hangars, mooring masts, helium tank cars, and large landing crews or landing machinery, are certain to make its operating costs higher per passenger than that of the airplane. For approximately equivalent loads dirigibles still have much longer range than flying boats ... True, the increase in range of the flying boat will enable it to negotiate the Atlantic to Europe with as much reserve in range as the dirigible formerly had. But there are some very long non-stop routes ... such as San Francisco to Japan, San Francisco to Australia, New York to Rio de Janeiro, New York to South Africa, etc., which are at present still too long for economical operation of flying boats of under 150,000 pounds without refueling or intermediate stops. The dirigible still has potentialities for this long range work.

Landplanes Considered

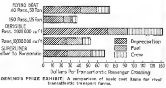
The land type of airplane with four or more engines is capable of effectively spanning transoceanic distances ... Yet is distinctly limited in comparison with the flying boat by its take-off requirements. There are no landing fields now available large enough to take care of the heavy wing loadings that can now be flown off the water. A good deal of work is being done on the "assisted" take-off, that is, by catapult, launching car, etc.

But ... as long as the flying boat measurably approaches the landplane in load capacity and in high speed, there does not appear to be any valid argument for abandoning the flying boat. Its added safety over water as well as its ability to land in many unprepared harbors at any time, is unmistakably an advantage over the landplane which could at most float for merely a few hours if forced down at sea ...

Those International Rights

Up to the present time the negotiations for air rights in overseas commerce have been made almost entirely by one American company (Pan America, of course) for its own commercial advancement. Pioneering this field, it acquired exclusive rights for its own operations in the foreign trade routes of the world and is for the present, therefore, in a unique position in this respect. ... The control by the British government of Bermuda and Newfoundland has led this American company into various arrangements and agreements with the British Imperial Airways designed for their mutual benefit, and finally to the issuance of permits for the operation by these lines by the Department of Commerce.

A British permit dated 22nd of February, 1937, signed by the Director General of Civil Aviation ... grants to Pan American Airways the right to operate two trips a week between the United Kingdom's customs airport serving London and the customs ports serving New York City—on condition that a similar permit of operation be granted to Imperial Airways by the United States Government. The Department of Commerce permit is similar except that Pan American Air-



LOENING'S PRIZE EXHIBIT A comparison of basic cost items for rival transatlantic transport forms.

ways is not specifically designated by the United States Government, but only "a United States airline company" The effect of the British permit, therefore, is to limit landings in Great Britain to Pan American Airways, for the time being. It may be pointed out that the importance of the use of Newfoundland, Bermuda and the Azores as necessary requisites to a transatlantic airline is constantly diminishing

There is no evidence as yet to justify the conclusion, so far as transatlantic flying is concerned, that there exists any limiting factors to the extension of shipping lines or new airlines into this field at any time.

MM Control Proposed

Inasmuch as aircraft have a definite place in overseas trade . . . it is recommended that aircraft be given a proper place in the Merchant Marine Act, 1936. To do so will merely require a broader conception of the term "vessel" so as to include ocean-going aircraft.

There is a need for assistance from the Government in the development stages of aircraft work . . . largely for assistance in covering the high initial engineering development cost of the large size aircraft here discussed. Consideration should be given modifications of the Merchant Marine Act, 1936, to permit 75 per cent construction loans on aircraft for the foreign trade or, failing private initiative, the construction by the Government of the first few of these aircraft and their charter to operators

With reference to the differentials between American and European construction costs and operating costs in the flying boat field . . . there is little or no differential in construction cost. . . There will be only a slight differential in operating cost. In the case of dirigibles this condition is not the same. . . No objection is seen to the inclusion of aircraft under the provisions of the Act for such construction and operating differential subsidies . . .

It is not considered wise in view of the newness of this field to suggest elaborate legislation at this time. An amendment to the Merchant Marine Act, 1936, making its principles applicable to aircraft . . . and permitting subsidized shipping companies to include capital expenditure for air developments . . . will encourage the entrance of shipping companies into the flying boat field. . . . It is believed that Mexican and Canadian overland routes are closely related to our domestic airline system and have little direct relation to shipping and its problems But air services over the ocean, not only foreign but intercoastal routes such as New York to Puerto Rico and San Francisco to Hawaii, are clearly in the field of shipping and of interest to the Maritime Commission

Transoceanic air lines should logically find . . . a place alongside of shipping in the Maritime Commission

LOGGING THE LINES

Air Transport Drift Sights by DAN SAYRE

EXPRESSLY DESIGNED A view of one of Northwest's new Lockheed 14's showing the numerous and easily accessible cargo compartments Northwest has just announced the order of four more of those ships over and above its original order for eight. Price of each ship complete About $90,000

This being the hindsight season for column-writers to make up for a year's errors by selecting All-American football teams and the Outstanding Whatevers of 1937, we feel an irresistable urge to join in the picking We offer therefore an idea of ours for what we will call the Airline-of-the-Year for 1937 You can best get what we have in mind by a few examples United would have been our Airline-of-the-Year in 1934 for the first demonstration of the practicality of high speed transport. TWA would have been our A-of-the-Y in 1935 for first infecting the world with what Englishmen call Douglasania A year ago we'd of strung along with the Collier trophy committee and plunked for Pan American and its demonstration of a successful trans-oceanic technique. Get it?

With no further ado we hereby suggest American Airlines as Airline-of-the-Year for 1937. Specification; For the demonstration during that year of a full perfection of the air transport sleeper, a development which it pioneered in 1934 and carried almost alone to such a point that the DST and its luxurious daytime sister ships led in 1937 to a whole new concept in air travel comfort. Its pioneering has yielded in many ways its own reward—a new leader ship in domestic passenger traffic volume; a recent favorable ICC action on an American petition for a wide increase in its mail payments. As a result American has good prospects for a no-loss balance sheet at the year's end in spite of heavy first and second quarter losses shared with many other airlines But American's sleeper pioneering also stimulated the entire industry So much so that much of this year's progress in total traffic (despite last winter's misfortunes) can be traced back to its timely pace setting

This sounds like it was written on parchment and hardly brings out the credit fully-due other systems for their part in the later stages of the march-toward luxury. But let it stand.

TWA folks get awful sore if anyone calls their new excursion rates "inter-airline rate warfare" or suggested the plan is a move to overcome the traveling public's skittishness about airline safety. American and United folks get awful sore if you even mention TWA. The new rates, installed last month, cut 15 per cent off all TWA round trip fares with the proviso that the "going trip" be started on a Saturday or a Monday and that the return trip be made within fifteen days. The cuts bring air fares in most instances just under corresponding rail-plus-sleeper charges

Jack Frye explains it all as a reasonable bid to people who heretofore have regarded air travel as a luxury and a sound business attempt to help keep up a TWA load factor which drops like everybody else's through the winter, which normally hits minimums Saturdays and Mondays, which is still a little thin on new TWA extensions

American says nothing beyond, "No cuts being considered". United hit the streets with a Patterson statement before the ink was dry on TWA's announcement "With railroad and steamship lines increasing fares because of higher operating costs which likewise are faced on all airlines . . . our company does not see how the public can expect airlines to reduce fares Last winter United successfully competed against reduced (TWA—Edit.) fares. On May 1 of this year, there was a general reduction in fares over the country in which United participated This reduced the difference existing between air and rail travel to a point which we think the public is willing and expects to pay for the advantages which air transportation offers . . . Furthermore . . . United is not satisfied that making a 15 per cent reduction below the present round-trip fares . . . and making this reduction good on only two days a week, is the answer to the airlines problem, or of material benefit to the public . . ."

Penn Central did a double shuffle on the inaugural flight of its new Washington-Buffalo service, starting two Boeings out of Washington together on the morning of Oct. 26. One of them, flown by J. H Neale, Penn Central operations manager, picked up pouches of first-cover mail at Baltimore, Harrisburg and Williamsport and also carried government and city officials from ceremony to ceremony. The other seems to have concentrated on officials. For-the-present schedules call for one flight each way, week days only At a mail contract rate of eight one-hundred thousandths of a cent per mile, the P O is going to owe Penn Central one shiny dime just a year from next Christmas

HOW'S THIS AIRLINE BUSINESS?

Best October! | The Big Four!

Still Below 1937! | Mounting Steadily

IT'S DOING FINE The indicator, which is the ratio of revenue passenger miles flown this October to the corresponding figure for 1936, still shows this year running well ahead of last although it is down from last month's 120.1 Around the chart lie latest available reports on the whole domestic transport picture. In the upper righthand quadrant, note TWA'S gains and Eastern's climb toward winter highs On the lower left hand chart note the continued lag of over-all load factors behind last year—traceable to increased capacities and schedules Both mail and express climb toward sure new record highs during the coming holiday season. Data for the indicator furnished by Air Transport Association

JUST 20 YEARS AGO

AVIATION reported—That a "remarkable" flight had been made from Chicago to San Antonio, Texas, by H. W. Blakley in a new L.W.F. biplane Average speeds Chicago to Muskogee 120 m.p.h., Muskogee to Dallas 130 m.p.h . . . That "the first fighting airplane wholly made in America of American materials" had just been flight tested. Officials of the Aircraft Production Board intimated the aircraft program would be well under way by January 1, by July 1 the U. S "expects to be able to supply any demands of its Allies. Estimates are 50 000 engines and 22 000 planes by that date . . That the Standard Aircraft Corp had been granted a N. Y. Charter authorized capital $5,000,000 . . . That Sam Browne belts cost only $6 or $7 in Paris . . .

AVIATION Published—A description of a "Terra Tutor," designed by A. C. Beach, which looked like a grandfather-twice-removed of modern Link Trainers . . . A description of the Lawson training plane complete with a tricycle landing gear . . . Descriptions of the Friedrichshaven Bomber and German Mercedes and Bentz engines . . . An article on Aircrew Analysis by A. F. Zahm . . .

AVIATION Advertised—Boyce Motometers . . . SKF ball bearings . . . Austin Standard factory buildings . . . Warner & Swasey turret lathes . . . Aluminum Company ingots, sheets, tubing, wire, rod and rivets . . . A classified offer of a "new seaplane $900 or a Curtiss 90 hp motor $1,000" That must have been some seaplane

You've got to see the Lockheed-14 workout to really appreciate it Les Smith had one of the new Northwest fleet in Washington last month showing it off to government officials A naval officer made a crack questioning the ship's climbing ability Next take-off Smith had the thing at 2,500 ft. before he'd crossed the end of the runway

TWA is certainly building a fleet of top flight equipment By the end of October it had expended or committed $3,487,500 for new planes during 1937 Last month it announced it had boosted this formidable figure by another $1,413,000 to a total of $4,891,500 Equipment already on hand consists of eight DST combination sleepers, five DC3 day planes, 18 to 20 DC-2's On order before the latest commitments were six of the big four-engined Boeing 307's This has now been increased to eight and orders have been placed with Douglas for four more DC-3's, two more combination sleepers

AS OTHERS FLY IT

A Birdseye-View of Aviation Abroad

VVERRKH SUDNO!. A zeppelin stayed up 119 hours in 1935 waiting for a Brazilian revolution to settle itself—thus set a world's record. Now the Russians earnestly developing semirigids under General Umberto Nobile claim a new one. Their new airship, the V-6, recently stayed up 120 hours in a cruise over European Russia. (Vvarrkh Sudno = Up Ship.)

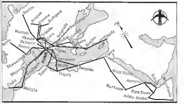
KLM has stepped-up frequency on its Amsterdam-Batavia service from two to three round trips per week . . . The Swiss government has established a weather station near the top of the Jungfrau which sticks up 12,672 ft. above sea level . . . Hanna Reitsch has flown the Focke-Wulff windmill plane on a 67-mile non-stop hop, breaking the existing windmill plane record by 57 miles . . . Jean Batten, who gets our vote as No 1 British airwoman, has set a new all-sex solo record between Australia and England—5 days, 18 hrs. and 15 min in the remote case that you are interested . . . Air France has put the first of fourteen new Block 220 sixteen passenger transports to be delivered into service between Paris and Marseilles . . . The British expect to have a new aircraft-carrier, H M S Ark Royal (launched in April), in service by next July. Three more British carriers are already under construction. The keel for a fifth was to be laid down last month.

Dr. Eckener has a hot helium idea To keep wastage of that expensive commodity to an absolute minimum he is planning to prewarm the gas cells of the LZ-130 before take-off thus permitting full-capacity buoyancy without gas-loss as the ship climbs to cruising altitudes. Water-recovery apparatus will further eliminate valving to compensate for consumed fuel. A helium-washing plant is being built at the Frankfort dock. Meanwhile word comes from the Netherlands that the oft-rumored Dutch Zeppelin line between that country and the East Indies has become only a remote possibility. Such a service, for one thing, would not be eligible for helium purchases under the current U. S act.

That recent get-together at Lima, billed as the First Inter-American Technical Conference on Aviation and to which the U. S. sent a full delegation and the carrier Ranger, didn't get together on very much. Some very practical progress toward a two-continent weather network was effected. But only twelve of the twenty one American countries sent representatives. And of those Argentina and Brazil stood out against a Pan American air code on the grounds that none of the American countries save the United States had even worked out codes for their own uses. The conference's action setting up an Inter-American Permanent Commission on Aviation to draft such a code seems therefore rather futile. Brazil and Argentina also refused to join an Inter-American Federation on Civil Aeronautics on the grounds they already belonged to the F A I

Autogiros for military spotting, under study in America have also attracted official British interest. The Air Ministry has recently ordered five "jump-off" cabin jobs for tests with land and naval forces. Powered with 165 hp Siddeley Genet engines, the new ships are to carry two side by-side; will have wooden monoque fuselages.

Speaking of John Bull Imperial Airways has been taking steps toward extending its all-marine operations eastward from Egypt. The Empire Flying Boat Centaurus is making survey flights between Alexandria and Karachi. Three QANTAS pilots from Australia have finished flying boat courses in Southampton. Four more are expected for similar indoctrination . . . The Air Ministry has raised the fund for flying club subsidies from $125,000 to $175,000. Club planes numbered 207 August 1 against 144 Jan 1, 1936 . . . C E Gardner's speed of 233.7 m.p.h., with which he won the King's Cup Race for the second year in succession, still has the British Industry pretty excited—as well it might, since it was made over a 1,443 mile course with more bends in it than a pretzel



ROADS TO ROME: The steadily expanding web of international airways Il Duce has thrust out to build the prestige and speed the communications of the Second Roman Empire—otherwise routes under operation by Ala Litoria. Latest addition is the new tri-weekly service to Belgrade, Yugoslavia and Bucharest, Rumania.

Operators' Corner

An exchange of ideas on the problems of the commercial aviation industry

QUESTION 27: What has been your experience in selling airplanes to prospects who carry substantial life insurance? Have you found the ratings put on private pilots productive of sales resistance? What methods have you used to overcome the difficulties resulting from this condition?

Read the Policy

SOME OF MY PROSPECTS have been completely halted in their plans for the purchase of airplanes by the restrictions placed upon them in their life insurance policies. Others have found after reading and interpreting their policies that the restrictions were not as severe as they had supposed and that they would be permitted to own and operate their own planes without voiding their insurance.

An insurance man informed me that an individual who did not have the intention of flying at the time he signed his insurance contract would not have to wait for the incontestable period to expire before starting his flying activities. He went on to say that it would be necessary for the insurance company to prove that he had had that intention in order to void the policy.

Some insurance men take a liberal view of flying and seem to look forward to the day when insurance policies will allow greater freedom for those who wish to fly. Others whose mental orbits are confined within the musty archives of their experience tables won't even take time to be shown what is going on in aviation. They remind me of a venerable old gentleman who lives a couple of miles from my home. He has never "sot foot" in an automobile and says he never will. I hope his pigheadedness will be defeated when he takes his last ride in a gasoline powered hearse. No doubt in some time to come we shall look with similar wonder upon those hangovers of a bygone day who neither set foot in an airplane themselves nor permitted others to do so.—ALFRED B. BENNETT, *President Bennett Air Service, Highstown, N. J.*

Liability Coverage Helps

IT HAS BEEN OUR EXPERIENCE that the present high rate charged by life insurance companies on policies issued to pilots, and existing policies which carry riders limiting the coverage in the event that the policy holder should take up aviation, has in many cases prevented airplane sales. Sales resistance created by this attitude of life insurance companies has been especially noticeable in cases where the sale would have involved an expensive airplane, in all probability fully equipped in a manner comparable with transport airplanes operated by scheduled airlines. We have as yet found no method of overcoming the difficulty resulting from policies which carry riders.

In the case of private pilots, who already possess the license and who are contemplating taking out new policies or increasing the coverage over old policies, we are, I believe, advising them to wait until such time as some life insurance company will take the initiative and write life insurance for them at a low reasonable figure. A company taking this initiative would receive our whole hearted support.

We have found a possibility of overcoming the life insurance difficulty in our charter service by protecting our passengers with passenger liability insurance taken to reimburse them in case their own life insurance would not apply.—E. W. WIGGINS, *President E. W. Wiggins Airways, Inc., Norwood, Mass.*

Discourages Flying

THE EXTRA COST of life insurance when a substantial amount is carried by a private pilot is a great handicap and I know of several of my own friends that gave up flying and sold their ships because of it.

I could not find any way to convince them that they should pay this extra charge which in the case of a doctor cost him $500.00 per year above his normal insurance rate. The remedy is in the hands of the insurance companies and should get their consideration.—FRANK MILLS, *Essington School of Aviation, Essington, Pa.*

Three Sales Lost

I KNOW OF THREE MEN in this area, all financially able to pay cash for instruction and plane, if the insurance factor had not been a deterrent.—W. D. CRETE, *Director Plattsburg Municipal Air-port, Plattsburgh, N. Y.*

Only commercial seaplane base is the Milwaukee Seadrome operated by Anthony C. Lange

Next Month's Questions

QUESTION 28: What specific methods have you used to promote your business? What forms of advertising have you used and to whom has it been directed? Have you made use of contests, premiums, exhibitions and with what success? What original methods have you developed for this purpose?

QUESTION 29: What are your reactions to the new Civil Air Regulations abstracted for the first time in the November issue of AVIATION? Are the requirements regarding licensed instructors qualifications for certificates of competency, medical examinations etc. in the best interests of the flying service operators? Are there any C.A.R. provisions to which you object?

"Here Goes Nothing!"

(Continued from page 25)

longs in the early daredevil stage of aviation attitudes. The spin-chute saves the airplane from loss and frequently saves the life of the test pilot—jumping from a spinning airplane has proved fatal to some of the world's best test pilots. The spin characteristics are cautiously explored by first making stalls, then half-turn spins, gradually working up to steady spins with various positions of the control surfaces as the recovery characteristics become more and more reassuring. Such methods of spin-testing where followed effected a reduction in lost airplanes and killed pilots. It happens quite frequently that an airplane thought to be perfect in spin-recovery and after many apparently perfect spins suddenly develops an uncontrollable spin without warning. Possibly a change in weight distribution or some other slight alteration may have made the difference in spin attitude. Then the pilot, unequipped with a spin-chute, may be killed, either through struggling too late with the controls or through jumping and being hit by the spinning airplane.

Spinning is dealt with in a new manner in the third stage of test piloting. The test pilot will, in the first place, have a counselling voice in the design discussions, and will here specify the size and disposition of control surfaces which, from his knowledge of spinning, he knows will give satisfactory spin-recovery as well as the most excellent controllability. A spinning model is then made of the airplane, correct in every detail of center-of-gravity and moments-of-inertia, and this model is tested in a free-spinning tunnel to determine exactly its spin-recovery characteristics. Finally when the airplane has been built in accordance with the requirement that no possibilities of failure get by at this point unexplored, it is flown cautiously and spun with an adequate spin-chute as described above.

NOT ONLY in emergencies like spinning but in all other phases of flight testing can one trace the three stages in flight-test approach. Nowhere so clearly as in the determination of controllability is the division made evident. Although a mistake in designing effective or manageable controls may and sometimes does, result in a crash on the first flight, the determination of safety at this point is frequently left almost completely to chance. If a rudder is overbalanced the test pilot of the first stage finds it out after he is off the ground, possibly even in an attitude of flight from which recovery is extremely difficult.

In the third stage controllability is approached from an entirely different angle. The effectiveness of controls is checked and rechecked by several aerodynamic methods in preliminary design. Controlled stability computations determine quite closely the quantitative values in turning, pitching and banking. On large airplanes the time required to execute a turn, bank or pitch can be computed and is now frequently specified by airlines for their new air liners. The control forces or hinge moments are more uncertain of exact computation, but wind tunnel testing of control forces is rapidly becoming common and will probably eventually be done on all new designs departing appreciably from standardized practice or patterns. It is only in this way that we can reduce the unknowns of testing airplanes to any such minimum as the few which remain for new steamers sliding down their ways for a trial run at sea. Yet it is not infrequent even now that large aircraft companies, which are still in the transitional attitude between the first and third stages run great risks on test flights of new aircraft by leaving controllability up to the chance that the test pilot will be able to get the ship down in case the controls have not been properly estimated as to aerodynamic over-balance, under-balance, or effectiveness.

Another illustration of changing attitudes in aviation can be seen in a review of the problem of flutter. Control-surface flutter is a phenomenon still imperfectly understood by many designers. Years ago when it occurred it was followed by the loss of the airplane through disintegration under the forces of vibration and aerodynamic loads. Even if the pilot was not killed he could usually supply little information after such an experience as to the sequence of events because of the rapidity with which failure followed the first appearance of flutter. Later, when the causes of flutter yielded to investigation and theory and tests, there were still many pilots as well as designers who buried their heads in the sand, refusing to believe that dynamic balancing might be a very serious omission. Fortunately there are already many "third stage" designers today who will build no airplanes without a complete dynamic analysis of the control surfaces and suitable provision for flutter prevention.

A RECENT DESIGN built for long distance racing was suspected by the test pilot of a tendency to elevator-flutter although he was unable to obtain any proof beyond an incipient stick vibration. The designer refused to believe in flutter danger or to provide flutter-preventing mass-balance. Diving tests on a sister ship resulted in severe flutter and structural failure of the stabilizer, whereupon static balance weights were added and found to provide freedom from flutter at the speed at which it had occurred before. Whether this proved that the speed for resonance had been pushed up or down by the addition of the static balance weights was not known, and only complete dynamic balance might have safeguarded all speeds. It was known that there are "flutter islands" in the speed range outside of which flutter would not occur at any speed and in which it might occur only if an inducing cause were present at the correct frequency to suit the structural stiffness and moments of inertia. Since the designer had refused to allow dynamic balance because the weights would, on this design, have to be placed outside the surface of the airplane, the test pilot strove to test the flutter possibilities by shaking the stick in dives at all speeds in order to supply the inducing factor which might eventually be supplied later by a bump at the proper speed to start flutter. The designer felt that this was all much too complicated and uncertain. Later the racer fluttered to pieces in a race and the pilot escaped only by quick-jumping with his parachute. A change in attitude of the designer would have saved both this airplane and the stabilizer of the former one which failed in testing.

The three stages of testing attitudes are clearly shown in these instances. They typify the progression observable in the behavior of all living things from the trial and error method of solving problems onward toward the eventual realization of complete scientific solutions in terms of foresight and planning.

Celestial Navigation

(Continued from page 29)

the azimuth The computed altitude is then compared with the measured sextant altitude to determine the position of the observer relative to the assumed position.

Circles of equal altitude—Since the altitude of a heavenly body would be the same for every position on the earth's surface equidistant from the body's geographical position, it follows that one altitude will not give a definite fix; nevertheless it will give a circle on which the observer's position must be.

In Fig 2, S is the geographical position of a star at a given time. If the observer were at S at this instant, he would see the star in his zenith i e, the observed altitude would be 90°. But if he were, say, 2,700 nautical miles away from S, his zenith would be over some point Z on the altitude circle instead of at S. Now we know that 1 nautical mile represents an angle of 1 minute of arc, so 2,700 nautical miles represent an angle of 45°. Thus it is clear that the star S would be 45° away from the observer's new zenith. Trials would soon indicate that there were a great number of positions on the earth from all of which this heavenly body would have the same zenith distance of 45°, and all these positions would lie on a small circle having the geographical position of the star as its centre. Such a circle is known as a *circle of equal altitude*. Having measured the altitude of a star and knowing its geographical position, the navigator can find the circle of equal altitude upon whose circumference he must be situated. By immediately observing a second star he can determine a second circle of equal altitude, which also passes through his position. The intersection of the two circles of equal altitude fixes his position. While in general there are two intersections of these circles, the navigator always knows his position closely enough to eliminate one of them.

The line of position—It is not usual to include the whole earth on any one chart, only that part of immediate interest to the navigator is shown. Hence the whole circumference of circles of equal altitude would not appear; as the radius of the circle is usually large, the small, slightly curved arc in which the navigator is interested may be replaced by a

Fig. 4 How to obtain fix line of position

straight line without appreciable error. This line is called a *line of position* or *position line* or *Sumner line* after Captain Thomas H Sumner, an American shipmaster, who discovered it in 1837. The direction of the line of position on the map must clearly be at right angles to the radius joining the navigator's position to the geographical position of the heavenly body, in other words, at right angles to the true bearing or azimuth of the heavenly body at the instant at which the observation was made. All the methods of interest to the navigator are based on the method of Marcq St. Hilaire, which makes use of the difference between the observed altitude and the altitude computed with the aid of an assumed position.

Plotting a position line on a chart—To lay down a line of position on a chart by the method of Marcq St Hilaire, it is necessary to take the dead reckoning position, or some convenient point close to it, and to compute for this assumed position the altitude and azimuth of the observed body at the time at which the observation was made. If the altitude observed with the sextant agrees exactly with the computed altitude, the altitude difference is zero. Then it is only necessary to draw from the assumed position A (Fig 3) a line of bearing AB along the computed azimuth of the body and a line CAD at right angles to this, then CAD is the required line of position.

If, however, the observed altitude is greater than the computed altitude, say by 15′, which equals 15 nautical miles on the earth's surface, the observer is nearer to the geographical position of the heavenly body than the assumed dead reckoning position would indicate. In this case the position line must be moved closer to the geographical position of the heavenly body by the amount of the altitude difference. Hence the intercept AE is laid off 15 nautical miles towards the body along the computed azimuth, and the position line FEG is drawn, as before, at right angles to the azimuth line AB.

The fix—If two position lines similar to FG in Fig 3 are found, the actual position or fix, assuming there are no errors in the work, will be at their intersection. If three position lines, such as Ab, CD and Ef in Fig 4, are determined, the true position may be reckoned to be somewhere within the shaded triangle or "cocked hat."

To determine a number of lines of position, it is necessary to take nearly simultaneous observations of different heavenly bodies or to get radio bearings of stations of known position.

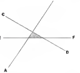


Fig. 3 Plotting altitude difference and

It should be remembered that the nearer lines of position are at right angles to each other, the sharper and more clear-cut their intersection will be. As the angle between two lines of position diminishes the intersection becomes less clearly defined, until, at 15° or less, little faith can be placed in the fix obtained.

Whenever stars are visible it is an easy matter to select a pair of stars whose position lines will give a good "cut." During the daytime, however, the sun is usually the only heavenly body available. In marine navigation it is the practice to derive a position line from two observations of the sun several hours apart; by moving

(Turn to page 77)

Celestial Navigation

(Continued from page 74)

the first line parallel to itself for a distance equal to the estimated run between the observations, it is made to cut the second line, and thus give a fix

In the air, however, this is of doubtful value because the high speed of the aircraft, and possibly of the wind, makes it impossible to estimate accurately the run between observations It will usually be found more satisfactory to consider these lines separately in celestial navigation A single position line will almost always give valuable information and often all that the navigator requires.

Consider the case where the position line is parallel to the course of the aircraft Then its distance from the course, as laid down by dead reckoning, will give the navigator an indication of the accuracy of his dead reckoning and perhaps warn him of a change in the direction or intensity of the wind. Similarly, if the position line is perpendicular to the course, the navigator can determine the approximate distance he has travelled. In this case the course plotted by dead reckoning may be regarded as a position line, and its intersection with the astronomical position line will be the most probable position of the ship.

It should be remembered that at certain times the Moon, Venus, and Jupiter may be available in the daytime, and may be used to give additional position lines that will cut the Sun line, or cut each other

Position lines by azimuths—The careful reader may wonder why the navigator does not get a fix by using the observed altitude of a heavenly body in conjunction with its observed azimuth The answer is that he can do so, but it is not worth while because the accuracy obtainable is very poor

The altitude can be measured with sufficient accuracy, but the azimuth cannot be obtained with a comparable degree of accuracy On an aeroplane the azimuth determination of a body at altitudes up to or about 30° is accurate to about 1°, this would give a range of intersection with a position line at right angles to the azimuth of 50 to 60 miles each way

This inaccuracy arises from the great distance of the geographical position of the body from the observer's position As soon as this distance is decreased by using another body having a nearer geographical position, the altitude of the body is increased so that, although the distance is then small enough to reduce the error due to distance to a reasonable amount, the altitude is so great that the observation of azimuth becomes very inaccurate owing to the effect of errors of the level of observing instrument.

Limits of Accuracy—To be of practical use to the navigator, the results obtained by celestial navigation must fall within the limits of speed and accuracy required in the air. We may approach the problem by saying that if a position within five miles may be obtained in five minutes or less, then celestial navigation is of real value to aviation

Further experience may change these figures somewhat, but the principle is correct, namely, that methods that are to prove useful in navigation must be within certain limits of speed and accuracy Actually, a line of position may now be worked in the air in less than three minutes during the daytime, if working with stars during the night, a definite fix may be determined in about one minute, with an average accuracy of about five miles

Summary—Briefly, celestial navigation consists in finding and plotting on a chart one or more lines of position. One line of position gives the navigator certain useful information Two or more lines of position determine by their intersection a definite position or fix To determine a line of position, the navigator must take the following principal steps

(1) Observe the sextant altitude of a known heavenly body
(2) Note the exact time of the above observation.
(3) Take the declination and the Greenwich hour angle of the observed body from the Almanac for the Greenwich Civil Time of observation
(4) Apply the assumed longitude to the Greenwich hour angle to find the local hour angle
(5) Compute the altitude, using an assumed position
(6) Compute the azimuth, using the same assumed position.
(7) Compare the computed and observed altitudes to obtain the altitude difference
(8) Set off the altitude difference along the computed azimuth and draw the line of position at right angles to it.

The practical application of the principles outlined here will be discussed in the succeeding installment.

Waco N

(Continued from page 34)

draulic brakes on the rear wheels are a part of the left rudder pedals They are toe-operated Retractable rudder pedals are provided for the right front seat and a throw-over wheel makes the airplane readily flyable from either seat

Brakes actuate the rear wheels only and are used for steering on the ground, the front wheel being of the castor type and non-steerable It is possible to describe circles around either rear wheel as a pivot

A parking brake is actuated by a lever immediately to the right of the control column accessible to either of the front seat occupants

Instruments are mounted in a shockproof indirectly lighted panel with grained wood finish which is duplicated in window moldings and other interior metal trim

A trimming tab on one elevator is adjusted in flight from a control wheel on the central control column Flaps are controlled with a crank valve in the roof between the two front seats A quarter turn is used from the full-on to the off position

Waco Model N characteristics

Make and model of engine	Jacobs L-5
Rated power at R P M	285-2,000
Span overall	34 ft. 8 in
Length overall	26 ft. 8 in
Height overall	8 ft. 7 in
Wing area	246 sq ft
Gross weight Normal	3,650 lbs
Empty weight Standard	2,380 lbs
Disposable load Standard	1,270 lbs.
Pay load Normal	642 lbs
Wing loading	14 83 lbs./sq ft
Power loading	12 81 lbs /H.P
Fuel capacity Normal	70 gals
Fuel capacity Maximum	95 gals
Oil capacity Normal	5 gals
Oil capacity Maximum	6 gals
Standard Equip propeller	Curtiss Reed
Top speed S L. 105% R.P.M	154 M P H
Cruising speed optimum altitude (6000-9000 ft)	144 M P H
Cruising speed sea level	135 M P H
Landing speed sea level	58 M P H
Climb first minute	800 ft
Service ceiling	16,000 ft.
Fuel consumption at best cruise	17 gals /hr
Range at best cruising speed with maximum fuel and 15% reserve	682 miles
Landing gear tread	98 in

Solving Space Structures Graphically

(Continued from page 31)

length in any view Solving the side view as before, we mark point "d" in both views and also mark the stress Ad as compression. Turning to the front view we notice that we must apply not only the phantom load Pd but also the side component of Ad This side component is dd' and acts to the right. We add it to the phantom load and obtain R. The rest of the solution is as before. Notice that all three stress vectors must now be revolved before they can be scaled.

Fig. 4a shows a combination case which is almost general except for the condition that in side view AB is superimposed on AC. Pd is parallel to ABC. The phantom load Pd' is the vertical projection of Pd. The resultant applied load R contains the phantom load Pd', the side component P, of the applied load and the side component dd, of the stress in AD. Before scaling the vectors are revolved.

Before passing to the perfectly general case we may take note of a frequently met special case shown in Fig. 4b. AB is perpendicular to AC and both are in a plane which is normal to the plane of the paper. It will be seen that both views can be solved as plane structures since neither AB nor AC have any components in the side direction or in each other's direction. The projection of the stress in AD will be the same whether obtained from the one or the other view.

Finally let us remove the last condition, 5, by drawing the structure so that AB and AC are no longer superimposed in any view. This perfectly general case is shown in Fig. 5. To solve this proceed as follows:

General Case

1. Thru A draw, in both views, a line parallel to AB. Thru the front end of the load vector draw a line (in both views) parallel to AC. The intersection of these two in the top view is called point "O".
2. In the top view select an arbitrary point "P" on the first line and draw a line parallel to AD mark point "M" as shown.
3. Project P to the side view and mark "P'". Draw through it a line parallel to AD in the side view. Project point M on this last drawn line and call this point M'.
4. Project O on its line in the side view and call this point V. Join V and M' with a straight line and where this line intersects the line through the front of the load vector mark point N.
5. Draw through N a line parallel to AD and mark point R. Then the side view projection of the stresses are as follows:

R-A is the stress in member AB,
R-N is the stress in AD and
N-S is the stress in AC.

To find the projections of the stresses in the other view, project N' and R' and join them. The check of the correctness of the work is that N'-R' must be parallel to AD.

Again, the top view projections of the stresses are R'-A, R'-N' and N'-S.

Each stress is parallel to the member to which it refers. To find the nature of the stresses follow around the polygon of stresses beginning with the load vector: Mark the direction of each stress by means of an arrow at the point A; thus S-N goes to the right, and so does the arrow point at A in member AC, which makes the stress tension. N-R goes up, and the arrow at A likewise goes up, making the stress in AD compression. R-A goes to the right and so does the arrow at A, making the stress in AB tension. The same can be done in the top view and serves as a check on the correctness of the work.

Explanation of General Method

We can no longer use the side view to get the stress in one of the three members, since we have three directions, whereas before we had only two. It is, however, still necessary to resolve the load vector into three components parallel to the respective members.

We know that the stress in each member must be represented in each view by a line parallel to that member. Starting at A we can draw a line parallel to AB and somewhere on this line must be the point indicating the magnitude of the stress in AB. Similarly, we can draw a line through the front end of the load vector and we know that somewhere on this line must lie the point defining the magnitude of the stress in AC. When these two points are joined by a straight line, this line must be parallel to AD, —if it is to represent the stress in AD It is obvious that we can draw any number of lines parallel to AD and intersecting the first two lines, but only one of them will be correct, and that is the one whose projection in the other view will be parallel to AD in that view. Let us guess at the magnitude of the first stress by selecting an arbitrary point P. (See Fig. 5a.) This would make AP the stress in member AB. Drawing through P a parallel to AD we close the polygon of forces which consists of the load vector and the stresses A-P, P-M and M-S. Let us now test the correctness of our choice of point P. To do this we locate P' in the side view and draw through it a line parallel to AD, just as we did in the top view. If the intersection of this new line with the line through S lies vertically below M (i.e., is the true projection of M in the top view), then the point P gives the true stresses. But we find that the projection of M on the line parallel to AD does not fall on the line through S (in the side view), but falls considerably lower, at point M'. Let us try point P_a, somewhat nearer to point 0. Going through the same process again we obtain point M_a, P_a and M_a; the last point, while not on the desired line through S, is already nearer to it than M'. It is obvious that by selecting the points P nearer and nearer point 0 we will obtain points M which will go higher and higher towards the line through S. We will also notice that all points M lie on the same straight line. It follows that all we need to do is to pass a line through M and M_a and its intersection with the line through S will be the correct point M. We can now work backwards and find the corresponding point P' by drawing through the true point M a line parallel to AD. We project P' and get the true P. A line through P parallel to AD gives the true components of the load and also the top projection of the loads in the three members. As a check, the true M point in the top view, as projected from the side view, must lie on the line drawn through the true P parallel to AD.

Actually it is not necessary to go through all this work. An examination of Fig. 5a shows that the point M' is the apex of the trapezoid PP'M'M'. Likewise, M_a is the apex of $P_aP_aM_aM_a$. The successive locations of P will give rise to more trapezoids each narrower than the preceding one; when, finally, point P coincides with 0, the trapezoid changes into a straight line; its width is zero. Its apex is the lower point of this line and lies on AP'. Therefore,

(Turn to page 81)

Space Structures

(Continued from page 78)

after finding the first apex M, all we need is to project 0 to the line AP' and we have a second apex. The two are sufficient to determine the locus of all the points M and we can draw this line through M' and the last point. As before, the intersection of this line with the line through S gives the projection of the true stress in the member AC, and the other stresses follow.

In view of the great variety of tripods and of the difficulty in avoiding mistakes in the work, it has been found necessary to create a nomenclature which helps to fix the procedure.

Fig 5b gives the names of the various lines and points. The line AP is drawn through the tail end of the load vector, hence it is called "Tail line" (T.L.). It is parallel to AB, which thus becomes the "Tail member" (T). The line drawn through the front end of the load vector is the "Front line" (F.L.) and member AC is the "Front member" (F). The line through P is the "middle Line" (M.L.) and AD is the "Middle member" (M). The intersection of the M.L. with the F.L. is the "Auxiliary point" (A.P.). In the side view the line through P' is the "Auxiliary middle line" (A.M.L.) and the projection of AP on it is the apex of the maximum width trapezoid or "Maximum apex" (M.A.). The projection of 0 on the T.L. is the "zero width apex" (Z.A.). The line ZA-MA intersects F.L. at the "True point" (T.P.); the projection of T.P. to the F.L. in the top view is T.P.'. The true M.L. drawn through T.P. gives the point R. The projection of the latter on T.L. gives R'. The line R'-TP' is the true middle line and must be parallel to the M member.

With the aid of this terminology the procedure may be described as follows:

1. Draw the two views of the tripod and of the load. Mark the members in the top view arbitrarily F, M and T. Mark the corresponding members in the other view the same way.

2. Through the tail end of the load vector draw T.L. parallel to T and through the front end of the vector draw F.L. parallel to F. Do this in both views, in the top view mark 0, the intersection of F.L. and T.L.

3. On T.L. in the top view choose a point P and through it draw M.L.; mark its intersection with F.L. as "A.P.".

4. Project P on T.L. and Mark P'. Draw A.M.L. through P' parallel to M in the side view, project A.P. on A.M.L. and mark point "M.A."

5. Project 0 on T.L. and mark "Z.A."

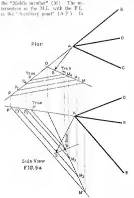
6. Connect Z.A. and M.A. and mark the intersection of this line with F.L. as T.P.

7. Draw M.L. through T.P. and mark point R. Project R to T.L. and get R'. Project T.P. to F.L. and get T.P.'. Connect R' and T.P.'. This line must be parallel to M.

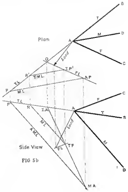
The resulting stresses can now be laid off on the corresponding members and the lines must be revolved to find the true lengths before scaling them.

Notice that P, P', R, R', 0 and Z.A. are T.L. points. T.P., T.P.' and A.P. are F.L. points. M.A. is an A.M.L. point.

Such is the theory of the graphical method for solving space structures. A systematic procedure has been worked out to make its application simple and mechanical and to permit anyone to check its correctness. Details will follow in a second article.



Side View
FIG.5a



Side View
FIG 5b

Producing the Ryan S-C

(Continued from page 33)

own on which patents are pending. This spar embodies approximately the foreward third of the wing; this nose portion being assembled as a single unit with major stresses carried by the outer skin which is stiffened by means of the nose ribs, and with a single vertical web located at about a third of the wing chord to complete the box spar.

All nose ribs, as well as the spar cap strips are formed on the drop hammer. These parts are all assembled in one continuous operation in a master spar jig. From this single spar, the trailing portion of the wing structure consists of cantilever ribs, covering all of this part of the wing being with fabric. From wing root to inner end of the aileron these ribs are built up from drop hammer formed cap strips and simple angle section diagonals. The outer portion of the wing carries one piece stamped ribs. These ribs are assembled to the nose portion of the wing panel in a master jig to assure perfect alignment. Thus it is apparent that the entire airplane, due to the nature of its design and to use of the manufacturing processes developed, requires but three main jigs for assembly. The extent to which drop-hammer processes have been utilized is shown by the formation of spar cap strips and cap strips for the built-up ribs by this process. Also in the case of certain flat sheet structural members, where use of stiffeners is required, we have stamped stiffening corrugations into the sheet itself.

There is a story within a story, however, in connection with our application of stamping methods to metal airplane production, for we have perfected two processes which we believe to be quite advanced steps in airplane manufacture. In producing the fuselage we have first built a full-scale plaster model, including cabin windshield, engine cowling, etc. On this model we experimented with cabin lines of cowling and windshield until we had exactly what we wanted. We then transferred the lines of the plaster model into metal by means of progressive steps starting with the model itself. Shells were built around the fuselage model at all bulkhead points, and at areas of compound curvature. Plaster casts were made, and from these plaster casts (female) we made plaster patterns (males). The plaster patterns were used to make sand molds (female) into which the zinc metal was poured to form one half of our forming die, the male portion. The "punch" half of the die was made by pouring lead directly over the zinc die. This may seem complicated, but the process actually is quite simple, and it has to be done only once—when tooling up for the production model. For the complete S-C plane we have built up more than 200 sets of dies.

The other new method we have perfected during the past two years is for finishing stamped parts. We call it the "nesting" template process, which consists of master stampings of sheet steel of contours identical to the production parts. These templates are carefully finished and serve as drill jigs. In practice this template is placed directly over the formed part, which is then trimmed to size and rivet holes are drilled to a degree of precision permitting complete interchangeability with any other part finished on the same master template. A good example of assembly of parts so finished is the nose cowling, built of 24ST Alclad sheet, every part of which is the stamped. This cowl, as with all other parts formed under this process, is assembled without the use of a jig since the jig function has been eliminated by the nesting template. It goes together without a hitch in rapid assembly routine and is completely accurate in all dimensions when riveted into a unit.

Tail and control surfaces throughout are similarly assembled from stamped parts either of aluminum alloy or steel sheet material. In keeping with the simplicity of the plane, the cantilever landing gear consists of a single fixed strut leg supporting each wheel directly from the single spar, with proper provision for oleo shock absorbing unit which permits seven inches of vertical travel, and brakes. The two planes are identical in design and construction except for differences of engine installation.

	With Menasco C4S 150 h.p. at 2050 rpm	With Warner Super Scarab 145 h.p. at 2050 rpm.
Wing span	37 ft. 6 in.	37 ft. 8 in.
Overall length	26 ft. 7½ in.	25 ft. 5½ in.
Overall height	7 ft.	7 ft.
Cargo (inc. pilot)	3 passengers 50 lb. baggage or miscellaneous equipment.	3 passengers 55 lb. baggage or miscellaneous equipment.
Wing area	202 sq. ft.	202 sq. ft.
Weight empty (standard equipment)	1335 lb.	1345 lb.
Useful load	815 lb.	805 lb.
Gross weight	2150 lb.	2150 lb.
Wing loading	10.7 lb./sq. ft.	10.7 lb./sq. ft.
Power loading	14.5 lb./h.p.	14.8 lb./h.p.
Maximum speed	150 m.p.h.	150 m.p.h.
Cruising speed (5500 ft.)	135 m.p.h.	135 m.p.h.
Landing speed	45 m.p.h.	45 m.p.h.
Rate of climb	900 ft. per min.	900 ft. per min.
Take-off run	175 yd.	166 yd.
Service ceiling	18,400 ft.	17,200 ft.
Maximum cruising range	500 mi.	500 mi.
Fuel capacity	37 gal.	37 gal.
Oil capacity	3 gal.	3 gal.

Materials and supplies used in connection with manufacture of the Ryan S-C are as follows:

Aluminum alloys—by Aluminum Company of America
Chrome molybdenum sheet steel (miscellaneous fittings)—Crucible Steel Co.
Chrome molybdenum steel tubing (motor mount)—Summerill Tubing Co.
Bronze (bushing stock)—Bunting Bronze and Brass Co.
Fabric—Wellington Sears Co.
Dope and paint—W. P. Fuller Co.
Engine—Menasco or Warner
Propeller—Hartzell
Wheels, brakes and tires—Goodyear
Instruments—Aeromarine
Hardware—Air Associates and Aero Supply
Engine Accessories (Starter, booster coil etc.)—Bendix.
Lights—Grimes Manufacturing Co.
Plexiglas—Röhm and Haas
Bearings—Fafnir and Norma Hoffman

Ocean Transport

(Continued from page 40)

complete de-icing equipment by Goodrich is of particular interest. Most unusual is the use of vacuum pumps to suck down the de-icers.

Radio equipment, specified by the purchaser, includes a Lear unit and a Simon Radioguide, a Sperry Gyropilot, two Directional Gyros, and Gyro Horizon also used.

The new ship is a substantial step toward larger flying boats. But in the minds of Chief Engineer Boulton, Project Engineers McCarty and Nightengale, Flight Engineer Ebel and other members of the able team that surround the spectacular figure of Glenn L. Martin are far bigger things,—boats that will make the present model seem small by comparison.

Specifications follow:

Wing Span	157 ft.
Overall Length	91 ft. 10 in.
Overall Height (on beaching gear)	27 ft. 2 in.
Height above full water line when moored	20 ft. 6 in.
Span of Ailerons	24 ft. 0 in.
Flap Length	92 ft. 8 in.
Span of Horizontal Tail	38 ft. 8 in.
Beam of Hull	11 ft. 3 in.
Span of Sea Wing	38 ft. 8 in.
Wing Chord—Max.	18 ft. 11 in.
Overall Height	24 ft. 6 in.
Gross Weight	63,000 lb.
Disposable Load	32,586 lb.
Weight Empty	30,414 lb.
Payload fuel and oil	30,458 lb.
Cruising Speed	145 to 170 m.p.h.
Altitude at which level flight can be maintained with only three engines operating at normal rated power for that altitude	10,000 ft.
Landing Speed (63,000 lb.)	70 m.p.h. or less
Take off time (from full throttle) with normal gross weight	25 sec.
Range (maximum)	3500 (route miles) to 5,000 (still air miles)

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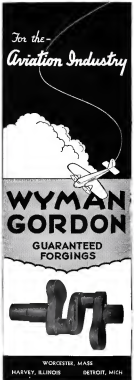
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1935 FAIRCHILD 24, 125 Warner. Excellent condition. Private owned $1975.00. Luther O Thomas 304 Chelsea Bank Bldg., Atlantic City New Jersey. No 19

1936 PORTERFIELD brakes tailwheel, speed-ring $1175. Taylorcraft demonstrators. Cubs $750 up. Kinner Gee Bee, brakes, steel prop $875. Best OX Bird in the country $650. OX Wacos $150 up. Many other ships. All ships licensed and in fine condition. Donald Hood. Jeffrey Airport, Northampton Mass. No 20

"Classified" INDEX

December, 1937

Advertisements in this classification are numbered [illegible] of last line each ad) for following

STINSON TRIMOTOR U and T parts; Pilgrim parts, Hamilton Standard adjustable propellers and Macpherson, Carburetor, Ignition switches, 15 Lycoming and Wasp B cylinders. General Airmotive Corporation, Municipal Airport Cleveland, Ohio. No 21

REARWIN SPORTSTER New May 1936, 70 LeBlond. Total time 575 hours. Speed ring compass, brakes, cab braces, motor majored. Price $1 750. Ringel Flying Service 917 Bigelow, Peoria Illinois. No 22

1934 WRIGHT-POWERED Waco de luxe. Beautiful hand-rubbed high gloss finish, interior perfect. Bank and turn, rate of climb, radio receiver, landing lights flares, generator, air brakes. Heywood air starter. less than 100 hours since completely recovered, refinished and majored $3,895. Air Activities, Inc. Municipal Airport Houston, Texas. No 23

WACO 35 Cabin Ambulance, Continental Engine just completely modernized. Rather excellent recently relicensed. Real buy at $2450. United Aero Corp P O Box 222, San Antonio, Texas. No 24

AIRPLANES motors, salvage. Crackups $35 up. Complete Directory with owner's price state and address 25c postpaid. Used Aircraft Directory. Athens Ohio. No 25

PORTERFIELD ZEPHYR. Brand new. Total time 14 hours. Continental A-40 motor. Red with blue stripe. Must sell to move stock $1150. Ringel Flying Service, 917 Bigelow Peoria Illinois. No 26

WE OFFER YOU opportunities to buy a Cub. Condition guaranteed 1935—$655 1936—$830 $895 1937—$895—$1100 according to hours. Avian $295 Aeronca C3—$600. All financeable. Bennett Air Service, Hightstown (Cobtown) New Jersey. No 27

ENGINES AND PARTS for sale. Liberty 400 h p, Hispano E 180 h p, also quantities of Pratt & Whitney Wright Curtiss and Packard engines. The Vimalert Company, Ltd, 813 Garfield Ave., Jersey City N J. No 28

BIRD—Kinner K-5, 3 place open biplane, good condition, new tires, $100.00 or trade for 35 or 37 Cub. Spartan Low Wing, Jacobs 55 HP, very good condition. 50 hours since Factory major. $700.00. Roland Maheux (Maheux Airport Auburn Maine. No 29

TPK SWALLOW 38 Model 20LB. Good condition. Will pay small amount extra for two or three place cabin licensed to March. C Olinger Milton Oregon. No 30

FREE AEROPLANE with motor purchase. Easy terms $12.50 down. 200 pounds useful load. Welded steel construction. Propellers all types—$8c up. Sensational values. Illustrated information and flying manual, 25c. Universal Aircraft, Fort Worth, Texas. No 31

CHALLENGER ROBIN, A-1 condition $750. Whittelsey Avian, just rebuilt and majored $200. Fairchild 22, A-1 condition $1250. Fairchild 21, majored and perfect shape $1150. Lambert Monocoupe, majored $2200. Fledgling Robin, and other parts. Aircraft Brokerage, Flushing Airport, Flushing, L. I. No 32

STINSON TRI MOTOR Model U, in A-1 condition, equipped with latest type 600-watt public address system of unusual power and tone. Exceptional money maker for right party. Present owner has other interests. Will sell at bargain or trade for high grade cabin airplane. F. S. 381 Aviation, 330 West 42nd St. New York City. No 33

WACO 1937 Custom cabin. Lights, flares, bank and turn, climb, clock, radio, pants, steel prop, large tanks, 5-place, Insignia blue with cream trim. 225 Jacobs 1 year old 160 hours. Never scratched. Forced to sell, cannot be told from new ship. Dixie Airways Inc, Shushan Airport New Orleans La. No 34

FOR SALE—Taylor-Craft excellent condition $1000.00. Taylor-Craft slightly used demonstrator. Davis, LeBlond powered, good condition $750.00. Waco Cabin Continental powered. Perfect condition $3000.00. Monocoupe motor just completely majored and in perfect shape, always privately owned. Member Fleded Flying Service, Inc. Lost Nation Field, Willoughby, Ohio. No 34A

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USED PARACHUTES bought, sold and serviced. Joe Crane Roosevelt Field Mineola Long Island N Y. No 37

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PONTOONS FOR SALE. Edo Model 3850. Hunter Company Shrine Bldg., Memphis Tenn. No 38

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EASTERN AERONAUTICAL CORP.—24 hour hangar service. Mobilgas and Mobiloil. Airplanes for charter and sightseeing. Also Stinson Lycoming Sales and Service. Airport, Newark N. J. No 43

Employment Opportunities on page 93

Continued from pages 90 and on page 93

Wanted

WANTED. Wright J6-5 in need of major. Also car engine in good condition. Cash waiting. Robert N Dobbins, 90 Pine Street, Verona N. J. No 44

WANTED. Pitcairn Autogiro. 5 place, license ? condition, with or without motor or covering. Jack West Rochester, Michigan. No 45

WANTED. Szekely Eaglet in need of covering or overhauling or slightly damaged. Give complete details. Cash. Lombard Airport, Lombard, Ill. No 45r

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NC 16023 1936 WACO CUSTOM 285 HP Wright motor. Controllable propeller. Turn & Bank. Rate of Climb. Flares. Landing lights, RCA Receiver, Clock. Thermocouple. Manifold pressure gauge. Carburetor temperature gauge. Custom proof time, special Diana cream with blue striping. Beautifully finished throughout. Total time 93 hours. Like new. $8 000

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(Continued from Pages 90 and 91)

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Left: Eclipse Propeller Anti-Icer Pump (variable output—12 or 24 volt operation) for application of ice removing fluids to propeller hub slingers and windshield.

Right: Eclipse De-Icer Oil Separator with integral regulating valve to control pressure to wing and tail De-Icers.

Left: Eclipse Remote Control Rheostat (shielded) for propeller "Anti-Icer" pump.

Above: Eclipse Electric Motor Driven Ten Port De-Icer Distributing Valve for 12 or 24 volt operation and for operation of wing and tail surfaces Goodrich De-Icers.

Below: Eclipse Electric Motor Driven De-Icer Distributing Valve (less integral control valve) for operation wing and tail surface Goodrich De-Icers.